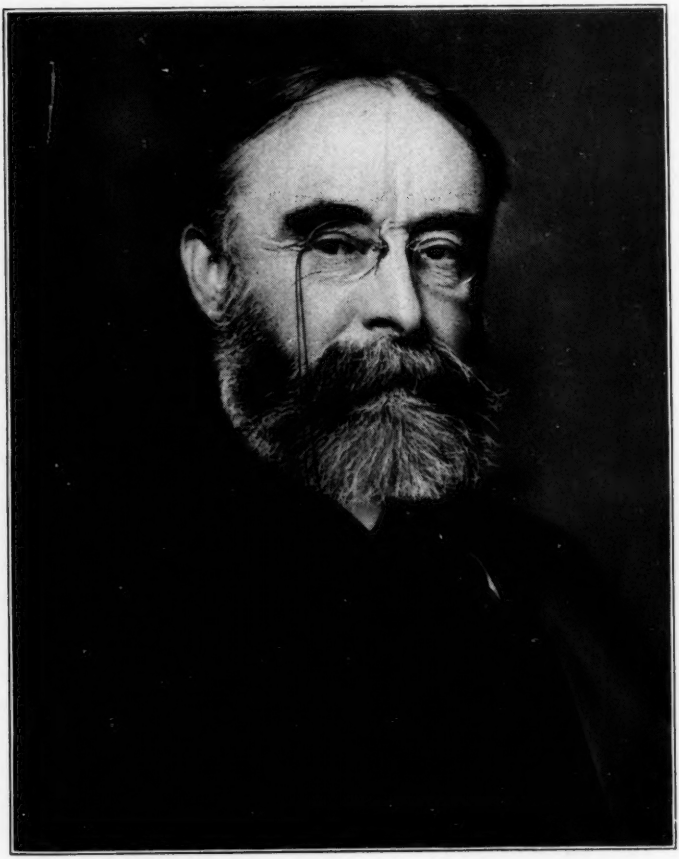

GEORGE FREDERICK PEABODY

President of the American Fisheries Society 1898–1899

BORN 1845 DIED 1909

TRANSACTIONS

OF THE

AMERICAN

FISHERIES SOCIETY

AT ITS

Thirty-ninth Annual Meeting

no 38th meeting.

JULY 27-28, 1909

At Toledo, Ohio

WASHINGTON
PUBLISHED BY THE SOCIETY
1910

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W. F. ROBERTS COMPANY
WASHINGTON, D. C.

OFFICERS FOR 1909-1910

*President*_____SEYMOUR BOWER, Detroit, Mich.

*Vice-President*_____W. E. MEEHAN, Harrisburg, Pa.

*Recording Secretary*__GEORGE F. PEABODY, Appleton, Wis.

Assistant Recording Secretary,

WARD T. BOWER, Washington, D. C.

Corresponding Secretary,

CHARLES G. ATKINS, East Orland, Me.

*Treasurer*_____C. W. WILLARD, Westerly, R. I.

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C. H. TOWNSEND, New York City.

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FRANK MILLER, Put-in Bay, O.

JABE ALFORD, Madison, Wis.

C. H. STEVENSON, Detroit, Mich.

AMERICAN FISHERIES SOCIETY

Organized 1870

The first meeting of the Society occurred December 20, 1870. The organization then effected continued until February, 1872, when the second meeting was held. Since that time there has been a meeting each year, as shown below, and the last meeting, in July, 1909, was consequently the thirty-ninth. The respective presidents were elected at the meeting, at the place, and for the period shown opposite their names, but they presided at the subsequent meeting.

PRESIDENTS, TERMS OF SERVICE, AND PLACES OF MEETING.

1.	William Clift	1870-1872	New York, N. Y.
2.	William Clift	1872-1873	Albany, N. Y.
3.	William Clift	1873-1874	New York, N. Y.
4.	Robert B. Roosevelt	1874-1875	New York, N. Y.
5.	Robert B. Roosevelt	1875-1876	New York, N. Y.
6.	Robert B. Roosevelt	1876-1877*	New York, N. Y.
7.	Robert B. Roosevelt	1877-1878	New York, N. Y.
8.	Robert B. Roosevelt	1878-1879	New York, N. Y.
9.	Robert B. Roosevelt	1879-1880	New York, N. Y.
10.	Robert B. Roosevelt	1880-1881	New York, N. Y.
11.	Robert B. Roosevelt	1881-1882	New York, N. Y.
12.	George Shepard Page	1882-1883	New York, N. Y.
13.	James Benkard	1883-1884	New York, N. Y.
14.	Theodore Lyman	1884-1885	Washington, D. C.
15.	Marshall McDonald	1885-1886	Washington, D. C.
16.	W. M. Hudson	1886-1887	Chicago, Ill.
17.	William L. May	1887-1888	Washington, D. C.
18.	John H. Bissell	1888-1889	Detroit, Mich.
19.	Eugene G. Blackford	1889-1890	Philadelphia, Pa.
20.	Eugene G. Blackford	1890-1891	Put-in Bay, Ohio
21.	James A. Henshall	1891-1892	Washington, D. C.
22.	Herschel Whitaker	1892-1893	New York, N. Y.
23.	Henry C. Ford	1893-1894	Chicago, Ill.
24.	William L. May	1894-1895	Philadelphia, Pa.
25.	L. D. Huntington	1895-1896	New York, N. Y.
26.	Herschel Whitaker	1896-1897	New York, N. Y.
27.	William L. May	1897-1898	Detroit, Mich.
28.	George F. Peabody	1898-1899	Omaha, Nebr.
29.	John W. Titcomb	1899-1900	Niagara Falls, N. Y.
30.	F. B. Dickerson	1900-1901	Woods Hole, Mass.
31.	E. E. Bryant	1901-1902	Milwaukee, Wis.
32.	George M. Bowers	1902-1903	Put-in Bay, Ohio
33.	Frank N. Clark	1903-1904	Woods Hole, Mass.
34.	Henry T. Root	1904-1905	Atlantic City, N. J.
35.	C. D. Joslyn	1905-1906	White Sulphur Springs, W. Va.
36.	E. A. Birge	1906-1907	Grand Rapids, Mich.
37.	Hugh M. Smith	1907-1908	Erie, Pa.
38.	Tarleton H. Bean	1908-1909	Washington, D. C.
39.	Seymour Bower	1909-1910	Toledo, Ohio

*A special meeting was held at the Centennial Grounds, Philadelphia, Pa., October 6 and 7, 1876.

CONTENTS

PAPERS AND DISCUSSIONS—*Continued*

PART I

BUSINESS SESSIONS

Transactions of the American Fisheries Society

Tuesday, July 27, 1909.

Meeting called to order at 10 a. m. by the President, Dr. Tarleton H. Bean, at the Secor Hotel, Toledo, Ohio.

PRESIDENT: Before proceeding with the regular order of business, I regret to have to announce the absence on account of serious illness of our worthy recording secretary, Mr. George F. Peabody. Mr. Peabody is now in the Presbyterian Hospital at Chicago, under the care of a specialist, and his condition is really alarming. It is on this account that Mr. Peabody, whose presence would be so delightful to us all, is compelled to be away. I do not know just how the members of the Fisheries Society will feel, but, for my own part, I shall miss Mr. Peabody as a very old friend who has been identified with this Society for many years, and who has done a vast amount of work which has inured to our benefit.

The following letter concerning Secretary Peabody has come to me from Mr. J. D. Steele, under date of Appleton, Wis., July 22:

"It is the unfortunate duty of the writer to tell you of the unexpected and I fear serious illness of Mr. Peabody, who was last night removed to the Presbyterian Hospital in Chicago, where he is under the care of Dr. B. H. Sippy, the stomach specialist. A stomach disorder of long standing has become acute and an operation may be necessary, this to be determined after a thorough examination.

"Unless a miracle happens within the next few days, it will be utterly impossible for Mr. Peabody to attend the Fisheries meeting at Toledo. It is a matter of keen disappointment to Mr. Peabody to be put out of commission just at this time. Any communications which you may want to send him will reach him if forwarded to his usual Appleton address."

A later letter addressed to me from Mr. Steele was to the effect that an operation would be performed. As to the re-

sult of the operation I am still in ignorance, but I hope all things will turn out for the best.

MR. S. F. FULLERTON, St. Paul, Minn.: Since Mr. Peabody is ill, I think there ought to be an acting recording secretary, and I take great pleasure in nominating Mr. Ward T. Bower for that position.

Motion seconded by Mr. W. E. Meehan, of Pennsylvania.

PRESIDENT: I was about to bring that up myself, before proceeding any further with the order of business. Of course, we cannot transact business without having a record, and you have heard the motion. The nomination of Mr. Ward T. Bower as acting recording secretary is made.

Motion unanimously carried.

MR. WARD T. BOWER, Washington, D. C.: I shall endeavor to do the best I can with the office of lengthy title.

PRESIDENT: Before the roll call of members is taken it would be best for me to announce that upon this table there are cards for application for membership, and I trust that they will be used. Mr. Bower also has an announcement to make, coming from one of our esteemed members in Washington.

MR. WARD T. BOWER: Through me the Hon. George M. Bowers, Commissioner of Fish and Fisheries, sends his greetings to the Society, and at the same time regrets his inability to be present at the opening of the meeting. He states that it is possible but hardly probable that he will be in attendance later on. He wishes and sincerely trusts that the meeting will be a success in every way. I am sure that it is a matter of regret to all that the Commissioner cannot be present with us upon this occasion. It is also to be deplored that Dr. H. M. Smith, the deputy commissioner, cannot be with us.

There was one duty that the Commissioner particularly charged me with. It is his earnest wish that the names of the President of the United States, the Honorable William Howard Taft, and the Secretary of the Department of Commerce and Labor, the Honorable Charles Nagel, be presented

to this Society for honorary membership. Therefore, I have the honor to make a motion to that effect.

PRESIDENT: I would suggest that we hold this matter in abeyance until the general subject of election of members comes up, and in the meantime, if you will permit, I would like to announce a committee on the reading of papers. There are some articles lying on this desk which are ready for use. There is also a provisional program to which reference can be made. I understand that some of the authors desire to be heard as soon as possible. Therefore, I think the whole subject should be referred to a committee, and we can then proceed in an orderly manner. I would name on that committee:

Mr. John E. Gunckel, of Toledo; Mr. Seymour Bower, of Detroit, and Mr. Charles H. Stevenson, Washington, D. C.

The roll call of members is the next order of business.

MR. C. W. WILLARD, Westerly, R. I.: The roll has usually been called by the use of cards to be passed in by the different members who are present, and the cards are here at the stenographer's desk.

PRESIDENT: I am reminded that the turning in of the cards constitutes the roll call. Please bear in mind that if any members come in later they should hand in cards.

The registered attendance at the meetings of the Society was as follows:

Bean, Dr. Tarleton H., Albany, N. Y.
Boardman, W. H., Central Falls, R. I.
Bower, Seymour, Detroit, Mich.
Bower, Ward T., Washington, D. C.
Brass, J. L., Drayton Plains, Mich.
Brown, Clarence, Toledo, Ohio.
Brown, Geo. M., Detroit, Mich.
Burnham, Chas. W., Tupelo, Miss.
Catte, Eugene, Langdon, Kansas.
Clark, Frank N., Northville, Mich.
Conway, R. J., Detroit, Mich.
Dean, H. D., Neosho, Mo.
Dickerson, G. C., Harrietta, Mich.
Downing, S. W., Put-in Bay, Ohio.
Englert, Andrew, Castalia, Ohio.

Evans, Barton D., Harrisburg, Pa.
Evermann, Dr. Barton Warren, Washington, D. C.
Filkins, B. G., Northville, Mich.
Fullerton, Samuel F., St. Paul, Minn.
Goodwin, H. D., Milwaukee, Wis.
Gunckel, John E., Toledo, Ohio.
Hartman, Phil. H., Erie, Pa.
Jennings, G. E., New York, N. Y.
Lydell, Dwight, Comstock Park, Mich.
Marks, H. H., Sault Ste. Marie, Mich.
Marks, J. P., Paris, Mich.
Meehan, W. E., Harrisburg, Pa.
Miller, Frank, Put-in Bay, Ohio.
Miller, Frank M., New Orleans, La.
Morton, W. P., Providence, R. I.
North, Paul, Cleveland, Ohio.
O'Brien, W. J., Gretna, Nebr.
Pomeroy, Geo. E., Toledo, Ohio.
Runion, H. P., Benkelman, Nebr.
Safford, W. H., Conneaut Lake, Pa.
Stevenson, Charles H., Washington, D. C.
Thayer, W. W., Detroit, Mich.
Thomas, W. H., Put-in Bay, Ohio.
Titcomb, John W., Washington, D. C.
Van Atta, Clyde H., Northville, Mich.
Willard, C. W., Westerly, R. I.

PRESIDENT: The treasurer will please read the names of those who have been proposed for membership.

MR. C. W. WILLARD: The following names have been presented for membership:

Ansley, H. M., New Orleans, La.
Boyer, L. A., 38 Drummond St., Montreal, Canada.
Campbell, G. D., Weymouth, Mass.
Day, Dana C., Toledo, Ohio.
Dowling, Dr. Oscar, Board of Bird, Game and Fish Commissioners, Shreveport, La.
Doyle, Henry, Vancouver, British Columbia.
Englert, Andrew, Castalia, Ohio.
Feick, John A., Sandusky, Ohio.
Hart, W. O., 134 Corondelet St., New Orleans, La.
Leis, Herman, Melvina, Wis.
Pfleuger, J. E., Akron, Ohio.
Pomeroy, Geo. E., Toledo, Ohio.
Ponder, Amos L., New Orleans, La.
Porter, O. S., Porterville, Ga.

Postal, Fred, State Board of Fish Commissioners, Detroit, Mich.
Power, D. H., State Board of Fish Commissioners, Sutton's Bay, Mich.
Reed, Dr. H. D., Cornell University, Ithaca, N. Y.
Runion, H. P., Benkelman, Nebr.
Van Atta, Clyde H., U. S. Bureau of Fisheries, Northville, Mich.
Yerington, Edward B., Board of State Fish Commissioners, Carson City, Nevada.

MR. WARD T. BOWER: I move that the names presented be elected to membership.

Motion seconded.

PRESIDENT: I have a letter from Mr. Charles G. Atkins, corresponding secretary, in which he proposes for corresponding membership Mr. S. M. Mohsin, Calcutta, India, representing the Bengal Fishery Department, and Mr. C. Riedel, Bergstedt, Germany. Mr. Atkins writes that Mr. Mohsin has been in this country for nearly a year past, studying our fisheries and fish culture, and that Mr. Riedel is a practical fish culturist in his own country. The name of Mr. Charles Flégel, member of the Imperial Austrian Fishery Society, Vienna, Austria, has also been presented for corresponding membership.

MR. J. W. TITCOMB, Washington, D. C.: I second these nominations.

The foregoing nominees to active and corresponding membership were thereupon unanimously elected.

MR. C. W. WILLARD: You will note on our list of membership that the President of the United States and the governors of the several states have already been elected honorary members of the Society.

MR. FRANK N. CLARK, Northville, Mich.: That will not interfere.

PRESIDENT: It strikes me that that would not interfere, for the reason that the title has passed over to other men since the election. The election is of the man and not of the office and under the circumstances it will be perfectly proper to vote for President Taft and Secretary Nagel.

MR. CLARK: At page 190 of the last printed proceedings, under the head of "Honorary Members," are named "The President of the United States" and "The Governors of the Several States." They are already members, therefore. However, I think as a compliment to the President it would be well to pass this motion, and he should be officially notified of having been elected.

MR. S. F. FULLERTON: Owing to the fact that the governors and presidents are changed quite often, I think the personnel, the men themselves, ought to be elected.

PRESIDENT: I think it is a very good plan.

MR. FULLERTON: That will include the governor of our state, the Hon. John A. Johnson, who is a great fisherman.

PRESIDENT: The question is on the election of the honorary and active members whose names have been read.

MR. MEEHAN: I think Pennsylvania should be added to the list.

PRESIDENT: That is all right—make it an individual matter.

MR. WILLARD: If we are to break up this old election of presidents and governors as it has usually been done, and are to name the president and also several of the governors, would it not be well at every meeting to have our secretary prepare a list naming the president and the governors of the different states, and have their names presented, and have constantly on our honorary list the president and the governor of every state by name.

MR. MEEHAN: That is right.

MR. CHARLES W. BURNHAM, Tupelo, Mississippi: That would eliminate any personal feeling in the matter.

MR. WILLARD: I make that amendment.

The amended motion was made, seconded, and unanimously carried.

MR. CLARK: I move the suspension of the regular order of business for the purpose of offering an amendment to the constitution.

Motion seconded and carried.

MR. CLARK: I would like to move an amendment to Article 3 in reference to the officers of the Society, by inserting after the words "recording secretary" the words "assistant recording secretary."

Seconded by Mr. Meehan.

MR. CLARK: I offer this amendment for the reason that we may, from time to time, be in the same situation in which we now find ourselves, our secretary being absent, and it probably would be unusual that the recording and the assistant recording secretary would both be absent. I therefore offer this amendment and I offer it thus early in order that it may be before the nominating committee so that they can provide for it if necessary.

PRESIDENT: We may act on this amendment to the constitution by a two-thirds vote.

MR. MEEHAN: I would suggest a standing vote.

The amendment was carried, 23 voting affirmatively out of 32 in attendance at the time.

PRESIDENT: The motion is carried by a bare majority and the constitution is amended.

ADDRESS OF PRESIDENT.

I see that by the constitution the President is to make a report. I was not aware of this fact, and I do not propose to take up very much of your time, but there is one matter that has come within my own experience as state fish culturist of New York which I think will be of interest to the American Fisheries Society. It is the living question of fish diseases causing epidemics and involving losses of thousands and tens of thousands and in some cases hundreds of thousands of fish at a single hatchery in a single season. While making this report I do not intend to anticipate what I have to say in my paper which lies here on the table. But I desire to call your attention to the fact that this state of affairs is a living issue with the fish culturists of the United States and of every country today, and it is one that must be met. How it is to be met you can help, I am sure, to decide. I have been

unable to. I have to turn for information from one source to another, and, as you will see when you look over the list of papers, I have catalogued, with my comments upon them, and the recommendations I have made, I know you will agree with me that it is a problem of a most serious and engaging nature.

Now, this question has been pressing upon us since we last met, but it is not new. Fish diseases are as old as the hills, and yet fish diseases have not been studied as long as the hills have been under the observation and investigation of scientific men. We are new in the study of fish diseases. We go to Germany for information. The scientific men of Germany take time to study these problems. I do not know whether they are better paid than we are or not; but at all events they find time. They get the opportunity to study fish diseases and we go to them for such little scraps of information as we can get. You all know that we do not get very much. We read about lymphosporidium, micrococcus, bacterium, and bacillus, and we are often inclined to wish that this jangle of words might find its way into the sea and be buried out of sight; yet we cannot afford to feel that way about it because the beginning of things lies in the investigation of the actual origin of disease. Treatment comes later on. In American literature on the subject there is little to help us. Dr. Hofer's book, in the German, gives some descriptions and a few lines of suggestions for treatment. There is the problem today; we know that these diseases occur; the fish are dying before our eyes. The different states and the United States are losing tens of thousands of dollars annually—perhaps more than that—from this cause; and our best results are brought to naught. As I say, that is the problem and the living problem before us today.

I do not know that there is anything else for me to report which would be of much interest to you. I can merely say that work in fish culture has been steadily growing during the past year; the states have increased their output; I

believe that they have improved their methods of fish culture and of transportation; and if we could only get rid of the troublesome words "bacterium," "bacillus," "lymphosporidium," "micrococcus" or whatever it may be—these horrible things that cause tuberculosis, small-pox, furunculosis, and the Lord knows what—we would all feel much better, and we would be, and our work would be, far more successful. (Applause.)

PRESIDENT: The report of the secretary is next in order. No report has been filed except as contained in the printed proceedings of our last meeting. The report of the treasurer is next in order.

REPORT OF THE TREASURER.

GENTLEMEN:

I herewith submit my annual report as treasurer of the American Fisheries Society from September 21, 1908, to July 27, 1909:

RECEIPTS.

1908.		
Oct. 15.	H. M. Smith, return of award	$100.00
1909.		
Mar. 6.	S. F. Fullerton, electrotypes	2.50
June 26.	G. F. Peabody, error 1908 account	25.00
	Sale of Transactions	44.22
	Yearly dues	654.00
		$825.72

EXPENDITURES.

1908.		
Sept. 21.	Balance due treasurer	$42.45
Oct. 13.	Stamped envelopes	10.72
1909.		
Jan. 26.	G. F. Peabody, services of clerk	25.00
Feb. 26.	Goodwin & McDermot, stenographers	140.20
Feb. 26.	G. F. Peabody, reports and mailing	278.81
May 24.	Stamped envelopes	10.72
July 26.	G. F. Peabody, circulars, etc., and mailing	25.77
		$533.67
July 27.	Balance, cash on hand	292.05
		$825.72

Respectfully submitted,

C. W. WILLARD, Treasurer.

Toledo, Ohio, July 27, 1909.

MR. WILLARD: In regard to the International Fishery Congress prize, the committee upon awards decided to withhold the prize, there being no paper presented which was thought to warrant an award. They accordingly turned the money back to the American Fisheries Society.

It is a source of great satisfaction to the treasurer to report a balance on the correct side of the ledger. Last year we had a deficit of about $50, the year before we had a small balance in the treasury, and four, five, and six years before that we had deficits all the way from $50 to $200.

MR. CLARK: I move that the treasurer's report be accepted and referred to the finance committee, and that the treasurer be complimented very highly for the excellent showing.

Motion seconded and unanimously carried.

PRESIDENT: The president desires to add his own appreciation of the good work of the treasurer. The auditing committee, which I think might as well be named now, will consist of Mr. Dwight Lydell, Comstock Park, Michigan; Mr. S. F. Fullerton, St. Paul, Minn., and Mr. S. W. Downing, Put-in Bay, Ohio.

We will now receive the reports of standing committees, and I will call upon the executive committee to report.

MR. W. E. MEEHAN: I would like to ask for the postponement of that until a little later.

PRESIDENT: Any other standing committees to report?

MR. MEEHAN: The committee on foreign relations, but I think you cannot get that report at present.

PRESIDENT: The committee on foreign relations cannot report until Mr. Titcomb arrives. He will have a report to make, but it will not be ready to present to this meeting, unfortunately. If there are no other reports of standing committees the next order of business is the appointment of committees.

The chair will appoint as a committee of five on nomination of officers for the ensuing year: Mr. S. W. Downing, of Put-in Bay, Ohio; Mr. W. H. Safford, of Conneaut

Lake, Pa.; Mr. Ward T. Bower, Washington, D. C.; Mr. W. P. Morton, Providence, R. I., and Mr. John E. Gunckel, Toledo, Ohio.

As to the committee of three on time and place of holding the next meeting, I would like to have some suggestions. I have two names I would like to place on that committee, but the third one is lacking. Two are Messrs. Meehan and Clark.

MR. BURNHAM: I would like to name Mr. Frank M. Miller, of New Orleans.

PRESIDENT: The committee on time and place of meeting will consist of Mr. W. E. Meehan, Harrisburg, Pa.; Mr. Frank N. Clark, Northville, Mich., and Mr. Frank M. Miller, New Orleans, La.

The chair would like to defer the appointment of the committee on resolutions until the next session.

Before the papers are read, I think the committee on papers should arrange them, keeping in mind the fact that in the reading of papers preference is to be given to the authors who are present.

MR. JOHN E. GUNCKEL: You know that I am the only resident member in the city of Toledo. In corresponding with the president, Dr. Bean, and the secretary, Mr. Peabody, we made arrangements to meet here in September, for I have found, after being a commodore for a great many years that we could entertain you very nicely in the month of September. But after Mr. Peabody discovered that some of the fish hatchery people could not come here in September, the time of meeting was suddenly changed, with about 10 days' notice, to this date. That left me in bad condition to make arrangements to entertain you as fishermen should be entertained, our mayor being away, our yacht men all out, and our hook-and-line fishermen all busy. Fortunately, though, the Castalia Trout Club, which has a national reputation, came in and offered to take care of us on Thursday, and part of the reading of your papers or discussion of papers can be carried on in their building at Castalia.

I hardly think that I ought to sit down without thanking the Society for coming to our town. We have a fine growing city here, with a population of nearly 200,000, and I have maintained the reputation of the American Fisheries Society here, having been a member since 1890. I have never been accused of telling a fish lie that I could not prove. (Laughter.)

Now, I want to show you what I have learned these many years with respect to building up and doing for other people. I have practiced in my life something of what the world is beginning to recognize as wonderful—not what Gunckel has done, but what I have discovered—in taking the little boy of the street, the boy who has a bad reputation, the bad boy, the boy who grows up to be a man whom we do not want, the boy who annoys the Sunday school and day teacher. Eighteen years ago, soon after I became a member of this Society, I began to take up these little boys, until today I have a membership in the city of Toledo of 7,000, with a building costing $100,000, all paid for. I have a national association with 10,000 members and correspondents all over the world.

Now, if you have time, I would like to have you come up to the building at one o'clock any day that you are here and see those boys of the street in bathing, in the swimming pool, and spend a half-hour in looking at the building. You will not have to spend much of your time, and we will show you what we have. The other day I had 110 boys in bathing; for 5 of them it was the first bath they ever had. One of them had his clothes sewed on. Don't you laugh, because you have them in every city. You give one of my boys 25 cents and tell him to get change, and he will do so and give you correct change. They have found over $35,000 worth of property on the street and turned it in to me. While Mr. Willard was there yesterday a boy brought in a comb he had found on the street; and he glories in being placed on the roll of honor. So I should think you would appreciate that one of your members is trying what you are

trying to do, to prepare food for the future. I am trying to make good men out of bad boys. I hope to see you at our building today at noon when you adjourn, that you may see those boys and see how busy and how active they are. The floors are all filled with them, reading and studying. There is no lying, no swearing, no fighting. I have to tell them fish stories every now and then; and I have to be a member of this society in order to get truthful material. (Laughter.)

I have the pleasure of introducing Mr. George E. Pomeroy, one of our leading citizens and an active member of the Castalia Trout Club. But note this—not as a matter of record, however—no one of the Castalia Trout Club fellows ever invites me to their stream to fish. Why? Because they know that I will clean it out for them. (Great laughter.)

MR. GEORGE E. POMEROY, Toledo, Ohio: I certainly am very happy indeed to have you with us in Toledo. So far as the invitation to you to visit our club at Castalia is concerned, we have Mr. Clarence Brown here who has given attention to that matter. He was not here when I told Mr. Gunckel I would be pleased to explain the situation, but he has come in since, and I will ask him to give you the details of what we are offering you on Thursday.

MR. CLARENCE BROWN, Toledo, Ohio: Mr. President and Gentlemen: By direction of the President of the Castalia Club, I am here for the purpose of extending to your Society an invitation to visit the preserve of that club at Castalia, and I understand you have just accepted for Thursday of this week. We will arrange, if you can indicate something like the number, transportation from the hotel to the club grounds. The cars of the Lake Shore Electric Railway pass the door here, and they also pass through our premises. It is a run of about two hours. We have made arrangements to charter the cars necessary to accommodate you all, and we will be glad if you will fix the time when it will suit you to leave and the time when you desire to return. We can very easily take you down

there, spend a day at the club house, see the premises, and return you here safe, and I had almost said sober, in the evening, but the latter is not guaranteed. (Laughter.)

You will find there a stream that I am sure will interest you. You will find, I think, the most convincing evidence of the successful artificial propagation of trout in a stream in which there are no *fontinalis* naturally. They were planted there a number of years ago, and since that time we have conducted the propagation of trout until we have really one of the most remarkable streams in this or any other country, so far as artificial preserves are concerned. I will not guarantee that any of you can catch any fish, and yet I will guarantee that you can all equal Gunckel. (Laughter.) He was invited once, and visited the stream. He did not get a fish. (Laughter.) He has never been there since.

We are carrying on in that association a work somewhat similar to his. We are not trying to make good men out of bad boys, but we have been endeavoring, unsuccessfully, for many years, to make good boys out of bad men, and Gunckel is beyond the reach of our association. (Laughter.)

Now, if your association will kindly indicate your acceptance of our invitation, we will make all the necessary arrangements and do the rest.

I would first like to inquire, Mr. President, as to the number that can probably attend. If that can be ascertained, and we can be advised, we will make arrangements accordingly. Again I would like to know when it would suit your convenience to leave and return. Cars will be provided and await your pleasure, and we will also provide some automobiles for your entertainment at the club. We will show you the waters of that trout stream which rise in Castalia and flow off into Lake Emma; we will show you both of the clubs there, their hatcheries, and their method of raising and planting fish.

If I can have that information, I should be pleased to

make all the arrangements necessary to suit your convenience. (Applause.)

MR. W. E. MEEHAN: I hope we will accept the invitation, but I would suggest Wednesday instead of Thursday. Usually we finish our business entirely by Thursday noon. Many of the members must go away about that time, and while it is possible that the meeting might be carried later than Thursday noon, it would be safer, I think, and insure a better attendance if Wednesday were decided upon rather than Thursday.

PRESIDENT: I take great pleasure in acknowledging the courtesy of your invitation, and all the more, because, if I remember rightly, it was in Ohio, in 1853, that the artificial breeding of brook trout began, with the experiments of Dr. Theodatus Garlick, of Cleveland. We have all heard a great deal about the famous Castalia stream, which is undoubtedly the finest stream in Ohio for brook trout, and the brook trout has been the first love of private fish culturists and public fish culturists since the time of Dr. Theodatus Garlick. It goes without saying that we are all interested in seeing a success such as yours. Therefore, we shall try to accept your invitation, and I will ask some of the members to immediately make such arrangements as are feasible, communicating with Mr. Pomeroy and Mr. Brown. I will ask Mr. Meehan and Mr. Fullerton to serve as a committee to take up this subject as soon as possible and let us know the result at the afternoon session.

MR. BROWN: Permit us to suggest, if it is thought desirable, that the Society visit the club tomorrow instead of Thursday. We can make arrangements, but we would like to know at the earliest possible moment, as our normal conditions do not provide for the entertainment of so large a number, and we shall have to make provision for your entertainment. I will communicate with the club by telephone and make arrangements for tomorrow, if it is thought desirable. I can do so as well as for Thursday.

FORTIETH ANNIVERSARY CELEBRATION.

PRESIDENT: The announcement can be made at the afternoon session, if that will be convenient.

There is a matter I would like to bring to your attention now, and that is the communication from Dr. H. M. Smith, Deputy Commissioner, Bureau of Fisheries, dated July 22. The communication is as follows:

The American Fisheries Society will soon reach the fortieth anniversary of its establishment, and it would seem proper that some recognition be made of this occasion and that a special program be arranged for an appropriate annual meeting.

If the matter seems to you to be feasible, will you please bring it to the attention of the Society for such action as it deems proper? I would suggest the appointment of a Fortieth Anniversary Committee, with full powers to determine the program and special exercises for that meeting, to solicit funds, and to do all other things that are considered necessary, provided the Society is involved in no unauthorized financial obligations.

MR. FRANK N. CLARK: I move that such committee be appointed.

PRESIDENT: The committee on time and place of meeting consists of Mr. Meehan, Mr. Clark and Mr. Frank M. Miller. With this communication before me, and with another, from the director of the New York Aquarium, I shall be glad if they will discuss the whole subject. Mr. Townsend's letter, dated July 23, is as follows:

It is fourteen years since there has been a meeting of the American Fisheries Society in New York City, where a meeting was held in the New York Aquarium on June 12, 1895.

I hereby extend an invitation to the American Fisheries Society to make its next place of meeting in The Aquarium.

I feel sure that the New York Zoological Society, the Museum of Natural History, and the city and state angling associations will be interested in the matter and that a meeting in New York can be made interesting to the members.

Hoping that you may be willing to recommend this proposal to your committee, I remain, etc.

PRESIDENT: You are aware, of course, that the American Fish Culturists' Association, now the American Fisheries Society, was founded in 1870, chiefly through the instrumentality of Livingston Stone, a revered member of this Society, and that Mr. Stone was ably seconded in New York by Robert B. Roosevelt, one of the first fish commissioners of the State of New York. The meeting took place in New York, and it would therefore seem to be historically interesting if the fortieth anniversary meeting could also be held in New York.

MR. CLARK: Is the next our fortieth meeting? I think that this is the thirty-eighth. The program so states.

PRESIDENT: The Society was organized in 1870 during the same year that there came into existence the Deutscher Fischerei Verein, and just the year before the United States Fish Commission was established. That is what I find in the records, not in our records, but in the general records of the history of fish culture. If I am wrong I should be glad to be corrected, but if that be true, as I believe it is, because it is published in the state reports of New York, published also by Mr. Clark in his review of fish culture, in the Manual of Fish Culture, and elsewhere—in fact, you can find it in almost any historical account of the beginnings of fish culture in the United States—if that be true, 1910 will be our fortieth anniversary, and it remains for the committee to consider these matters and to decide whether New York be named as the place of meeting.

MR. CLARK: Do we understand that the committee on time and place of meeting shall take this matter up also?

PRESIDENT: No; I would like to have a motion to appoint a special committee.

MR. CLARK: I move that a committee such as Dr. Smith suggested be appointed.

MR. FULLERTON: We should revise our records. Our notice says this is the thirty-eighth meeting. The matter should be set right.

MR. MEEHAN: That can be arranged by this special committee.

PRESIDENT: It is a matter to be investigated, because the American Fish Culturists' Association was certainly created in 1870.

MR. CLARK: I think that is right. If it is in order, I will state my recollection of the matter. I was not there at that time, however, I was engaged in fish culture. My recollection of the matter, and I think it can be traced in our proceedings 20 or 25 years ago, is that Mr. Stone gave a short paper on the history of the American Fisheries Society and the American Fish Culturists' Society. Now, as I remember, a few gentlemen, including Mr. Stone and Mr. Roosevelt, met in a room of some fish association in New York and organized at that meeting—merely organized—what is now the American Fisheries Society; and I think our president is right in saying that that organization took place in 1870. However, they did no business to amount to anything, any further than organizing, and the next year they had their meeting, and undoubtedly this thirty-eighth meeting that we now have on our program is taken from that. I think that is where the mistake is, but I do think that Mr. Stone, Mr. Roosevelt, and Dr. Hudson and eight or ten others organized the American Fisheries Society in 1870.

PRESIDENT: I have a reference to Mr. Stone's review of fish culture in the United States, if I can find it. I can tell later what Mr. Stone said about it.

Is the committee on papers ready to report?

MR. MEEHAN: Is not there a motion before the meeting to appoint a committee?

MR. CLARK: I moved that this special committee be appointed.

PRESIDENT: There are two committees to be appointed, one on resolutions and one special anniversary committee.

MR. CLARK: That motion has not been passed.

PRESIDENT: The motion is to appoint a special committee on the fortieth anniversary of the American Fisheries Society, a committee of five.

Motion seconded and unanimously carried.

PRESIDENT: The motion was made by Mr. Clark, and I will ask him to serve as chairman of that committee.

MR. CLARK: I suggest that you take some time and not appoint that committee now.

PRESIDENT: It is a little difficult to appoint such committees offhand.

MR. CLARK: There is nothing for that committee to do at this meeting, and the chair may appoint it the very last thing.

PRESIDENT: Yes, but I am sure that I shall want Mr. Clark as chairman of that committee. We will now hear the report of the committee on papers.

MR. JOHN E. GUNCKEL: We have taken the articles as they appeared, and we give preference to gentlemen present to read their papers. We have dovetailed the articles, as to subjects, and Mr. Stevenson will read the order in which they will be taken up pursuant to the recommendation of the committee. They will be read this afternoon, and will continue with a night session or tomorrow according to your pleasure.

MR. CHARLES H. STEVENSON: The list of papers that the committee has prepared for presentation this afternoon is the following:

Dr. Tarleton H. Bean, A Plea for the Systematic Study of Fish Diseases.

Mr. W. E. Meehan, Some Recent Experiments in Sturgeon Culture.

Mr. Ward T. Bower, Notes on the Increase in Size of Fish Ova after Water Hardening.

Mr. Charles W. Burnham, Notes on the Yellow Bass.

Mr. Andrew Price, The Economic Value of the Sportsman.

Mr. Charles H. Stevenson, The Fishery Census of 1908

The committee will make further report on papers to be presented later.

The report was accepted.

PRESIDENT: We will proceed with the miscellaneous business.

The matter of the visit to the Castalia Club preserve having been brought up and discussed at length, it was voted to start from the hotel at 8 o'clock a. m., July 28, on the special car provided by the club.

A recess was then taken until 1.30 p. m.

Afternoon Session, July 27, 1909.

The meeting was called to order at 2 o'clock.

PRESIDENT: The committee on the reading of papers has made a preliminary report, and the order of the papers for the afternoon has been determined on.

MR. JOHN W. TITCOMB: I would like to make an announcement. A few days ago my attention was called to a weed cutter manufactured by Aschert Brothers, of Milwaukee, Wisconsin. I do not know anything about this cutter, but if it is what the circular says it is, it is something that the fish culturists want, especially those engaged in pond culture. So I wrote to the firm and asked them to have it here, and be ready to demonstrate it, and one of their representatives has come. Moreover, I have been informed by a member of the Castalia Trout Club that the club will be glad to see a demonstration of this machine tomorrow at the preserve, and I therefore ask that Mr. Aschert go with the Society tomorrow morning at 8 o'clock, and have his cutter at the club grounds ready for demonstration. The circulars with reference to it are on the table.

The six papers previously announced, by Dr. Tarleton H. Bean, Mr. W. E. Meehan, Mr. Ward T. Bower, Mr. Charles W. Burnham, Mr. Andrew Price, and Mr. Charles H. Stevenson, were then presented. The papers and the discussions are printed in the second part of the proceedings.

MR. JOHN W. TITCOMB: I would like to ask whether there are any persons here who have papers of their own. It seems to me they should have the first chance to present them.

PRESIDENT: The committee on program has given me these six papers, and had before it a large number of papers, which are here on the table, but I believe not one of the authors of the papers which are here is now present. There are, however, papers by Mr. Seymour Bower, Mr. John E. Gunckel and Mr. Frank N. Clark, but the committee passed on those papers, consulted with the authors, and I am told these gentlemen are not quite ready for presentation. For that reason we go on to the first paper by an absent member.

MR. TITCOMB: My only object was to give those who are here an opportunity to read their papers first.

PRESIDENT: I would like to ask Mr. Seymour Bower, if he is present, whether there is a question box?

MR. SEYMOUR BOWER: There was a question handed to the committee, and I turned it over to Mr. Stevenson.

MR. MEEHAN: There were four questions.

MR. STEVENSON: The committee thought there might be a number of questions in the question box, and that it would be better to defer the matter.

REPORT OF THE EXECUTIVE COMMITTEE.

PRESIDENT: I will call for the report of the executive committee, Mr. Meehan, chairman.

MR. W. E. MEEHAN: The unanimous report of the executive committee is as follows:

The executive committee has the honor of making the following report of its work during the year.

Early in the present year your chairman received word from the president, Dr. Bean, and Dr. Henshall, that there was some difficulty in making suitable arrangements for holding the annual meeting of the Society in the Yellowstone Park. It was suggested, under the circumstances, that the committee designate another meeting place. A vote of the committee indicated a majority for Toledo. The president, Dr. Bean, and the secretary, Mr. Peabody, were notified of the change and preparations made for holding a meeting at Toledo, Ohio.

The committee was advised by Dr. Hugh M. Smith and the president that Mr. Charles H. Stevenson, of Washington, had suggested the establishment by the Society of a fund, the interest of which should be used for procuring a medal or giving a cash prize periodically to the person making the greatest achievement in fish-cultural work or the greatest achievement along such lines. The committee unanimously recommend that should any moneys be contributed for that purpose they be accepted and that such moneys be set apart and invested for the purposes suggested. During the discussion on this important subject the question arose as to whether or not the American Fisheries Society is an incorporated body, and if not, whether such a fund could be properly created and established. This committee, therefore, strongly recommends that if the American Fisheries Society is not incorporated steps be taken for incorporation, and a fund of the character named established as soon as possible.

The committee reports with sorrow the death of the following members:

Walter L. Powell, Harrisburg, Pa., in March, 1907. Mr. Powell was one of the early members of the Pennsylvania Fish Commission and for several years was its treasurer.

Westley S. Henry, Park Side, Pa., in September, 1908. Mr. Henry was a member of the Paradise Valley Brook Company, and its treasurer. He was also well known throughout Pennsylvania as the proprietor of a large hotel in Monroe County, the headquarters of thousands of anglers of Pennsylvania and New York.

Redfield Proctor, United States Senator from Vermont, on March 4, 1908.

R. D. Hume, San Francisco, Cal., in November, 1908. Mr. Hume was one of the pioneer fish culturists on the Pacific coast. It was he who demonstrated the practicability of artificially propagating salmon on the Rogue River.

A. Starbuck, Cincinnati, Ohio, in 1908. Mr. Starbuck was well known in Ohio as a propagator of gold fish.

L. D. Huntington, New Rochelle, New York, in April, 1909. Mr. Huntington was president of the Society in 1895-6.

The executive committee recommends that the above names be sent to the committee on resolutions for suitable action.

On motion duly seconded the report of the executive committee was adopted.

MR. MEEHAN: I wish to make some remarks with reference to the question of the incorporation of the society and with reference to this fund, more than could be put in a report of that kind. Whether you decide that it shall come up later or come up now, I should at some time like to speak on the question.

PRESIDENT: That is subject to motion. Do you wish to discuss that phase of the committee's report now? The report has been adopted.

MR. MEEHAN: But there is a recommendation in that report in regard to the incorporation of the Society and the establishment of a fund, the interest of which would be used for prizes or for medals, or something of that sort. The mere adoption of that report carries with it, of course, the question of doing this, and shows that the Society approves it, but it will require further action of this body to carry anything of that sort into effect. The question in my mind then is whether it is germane to take it up now or to take it up later.

PRESIDENT: That rests with the Society. What will you do about this matter?

MR. TITCOMB: I move that that portion of the executive committee's report relating to the awarding of prizes and matter relevant to the incorporation be referred to a committee consisting of the incoming president, secretary, and treasurer of the Society with power to act.

MR. MEEHAN: We might add to that committee, with Mr. Titcomb's approval, the chairman of the incoming executive committee, on account of the general business of the year.

MR. TITCOMB: That is accepted.

The motion was seconded and unanimously carried.

PRESIDENT: We will hear the report from the auditing committee, which will be read by the secretary.

ACTING SECRETARY: The auditing committee's report is as follows:

> We have examined the report of the treasurer, together with vouchers, and find the same correct.
>
> DWIGHT LYDELL,
> SAM. F. FULLERTON,
> S. W. DOWNING,
> Committee.

The report was adopted.

PRESIDENT: We will now hear the report of the committee on foreign relations.

MR. TITCOMB: The chairman of the committee on foreign relations is not here, but he wrote me stating that he will have the report ready in time to print.. Some of the matter prepared by that committee, especially its chairman, is quite interesting. Therefore, I suggest that if he has it ready in time it be printed as part of the transactions of this Society.

PRESIDENT: It is moved that the report of the committee on foreign relations be printed as part of our transactions if received in time for the printer.

The motion, seconded by Mr. Meehan, was unanimously carried.

MR. MEEHAN: I would like to announce that immediately after adjournment this afternoon, the committee on time and place of meeting will convene here at the officers' desk to hear suggestions for place of meeting. This committee consists of Messrs. Meehan, Clark, and Frank M. Miller.

PRESIDENT: The committee on papers is Mr. Gunckel, Mr. Seymour Bower, and Mr. Stevenson, and I would like to ask that committee to examine the papers which still remain and return them to the Society in the order for reading, if any of them are to be read.

The committee on resolutions has not yet been named, I believe, and the committee on the fortieth anniversary meeting has not been named. The chair would like to announce the committee on resolutions. He is not prepared as yet to name the other committee. The committee on resolutions is as follows: Mr. John W. Titcomb, Washington, D. C., chairman; Mr. S. F. Fullerton, St. Paul, Minnesota; Mr. W. E. Meehan, Harrisburg, Pa.; Mr. Seymour Bower, Detroit, Mich., and Mr. Dwight Lydell, Comstock Park, Michigan.

MR. TITCOMB: I move that the papers be referred to the committee on program, and that we have an evening session; and I suggest further that the committee assign some par-

ticular hour when matters relevant to pond culture may be discussed. I do not know whether there are any papers on that subject, but it is an interesting one, and all those who desire should have an opportunity to discuss it. It seems to me that we ought to have a time set apart for this when all of those posted on the subject should be present, in order to bring out all the information possible.

MR. MEEHAN: I suggest also that should there be in the question box any questions relating to pond culture, they be brought forward at the same time.

MR. CLARK: I wish to state that I have prepared no paper on the subject given in the program. The announcement is a mistake.

MR. GUNCKEL: When Mr. Peabody was here, he said he put me down for the subject which you will see on the program, and he said,"If we have enough papers you won't have to read yours." (Laughter.) Now, I have discovered a sufficient number of papers to have a discussion as long as you stay in this town, but I will tell you what I would like to have you do. It would be no trouble for me to prepare a paper, even if I had to leave you ten or fifteen minutes for that purpose. If I prepared a paper I would get through in thirty minutes. Now, if on Thursday you will adjourn here at 1 o'clock and come out to the newsboys' building at that time, stay ten minutes, and see 100 boys in bathing, some of them that never had a bath before, and five minutes to look through the building, and five minutes to get back here, that is half the time we would spend in reading a paper. If you will do that Thursday, I think you will discover something of interest, and when you go to your home you will say, "Well, there are other things besides fishing." I would like to have you consider that, but if you want a paper I can get off into a corner and figure one out very quickly. (Laughter and applause.)

MR. TITCOMB: We will probably all go to Castalia tomorrow, and I suggest to the committee that the subject of pond culture and all matters relevant to it be discussed there.

But I cannot close without suggesting also that after Mr. Clark reads his paper on "What is a Fingerling," Mr. Gunckel read a paper on "Why is a Carp." (Great laughter.)

PRESIDENT: I think Mr. Clark and everybody else will admit that it is no joke to raise fingerlings, even if fingerling be a joke.

The Society then adjourned until 7.30 p. m.

Evening Session, July 27, 1909.

The meeting convened at 7.30 o'clock.

PRESIDENT: The committee on the fortieth anniversary will be Mr. Charles H. Townsend, director of the New York Aquarium, chairman; Mr. Frank N. Clark, Northville, Mich.; Dr. Hugh M. Smith, Washington, D. C.; Mr. W. E. Meehan, Harrisburg, Pa., and Mr. George P. Slade, president of the South Side Sportsmen's Club, Long Island, New York.

MR. CLARK: Would it not be better to offer some name instead of mine?

PRESIDENT: The president does not think so.

MR. CLARK: It occurred to me today, after I made the motion and you very courteously appointed me as the chairman of that committee, or said you were going to, that it was very kind in you, but perhaps the members of that committee should be mostly New York men. Now if you are sure you have not enough on there for that purpose, I do not wish to shirk any duty.

PRESIDENT: We have one western man, Mr. Clark, four eastern men, one from Washington, one from Philadelphia, and two from New York.. I might say further that although not identified with the committee, I shall do all in my power personally to aid to make the fortieth anniversary meeting a great success.

MR. MEEHAN: As one of the members appointed on that committee I hope you will see that Mr. Clark's name is re-

tained there. Mr. Clark has been a constant attendant at the American Fisheries Society for a quarter of a century, and has not missed a meeting in that time. His experience in making arrangements would be invaluable to the committee, and I think Mr. Clark by all means ought to be a member.

PRESIDENT: I agree with you. I want to read a little paragraph in a letter from Dr. Smith, who wrote to me and to Mr. Willard on this subject. I think this paragraph has been incorporated in the resolution under which this committee has been appointed.

> I would suggest the appointment of a fortieth anniversary committee, with full powers to determine the program and special exercises for that meeting, to solicit funds, and to do all other things that are considered necessary, provided the Society is involved in no unauthorized financial expense.

I believe that is incorporated in the resolution so that this committee is charged with the duty as defined in that part of Dr. Smith's letter.

MR. TITCOMB: May I ask as to whether that will authorize the committee to incur the expense of postage up to say $20 or something like that?

PRESIDENT: I think the committee might as well be instructed now as at any time on that point.

MR. TITCOMB: I move that the committee be authorized to incur an expenditure for postage in an amount not exceeding $20, and furthermore, that the committee be authorized to edit and prepare a special commemorative edition of the transactions, if that is not included. What I mean is, that this committee shall have the arrangement of the publication of the transactions in this particular instance.

PRESIDENT: I think that was intended to be covered in this sentence, "with full power to determine the program and special exercises, solicit funds, and do all other things that are considered necessary."

MR. TITCOMB: Ordinarily that would refer to the arrangements and management of the meeting, and would

not refer to the publication of the transactions afterwards. I would like to see my suggestion incorporated and have it fully understood, and I make it as a motion.

PRESIDENT: It is moved that $20 be authorized to be expended as postage, and that the anniversary committee also be authorized to edit the papers and see that they are properly printed.

MR. MEEHAN: Before that is put—it meets my fullest approval—it seems to me there is another question that might arise to make it advisable to add another phrase. This committee is to make all arrangements, and is authorized to make arrangements for the program for this meeting. Now, such a program should be published beforehand and sent to the various members of the Society. That would necessarily entail an expense, not a large expense to be sure, but it seems to me that perhaps a little more might be added so as to cover the authorized expenditure for the printed program for this meeting. You now cover postage and correspondence. The committee will be authorized to prepare a program, but it is not authorized to print that program.

MR. TITCOMB: Your idea is that this committee should prepare that program instead of the secretary?

MR. MEEHAN: Naturally, it says so.

MR. TITCOMB: Then I should think that instead of limiting it to $20 they be authorized to make the necessary expenditure for postage, preparation and printing of program, etc.

PRESIDENT: Do you think that this is not sufficient authority for the committee "to determine the program, special exercises and solicit funds." What are these funds for except for the necessary purposes to which you refer?

MR. S. F. FULLERTON: This $20 doesn't look good to me —limiting the committee to $20. If the committee is going to do the secretary's work and send out circulars and programs for the meeting, it ought not to be limited to $20.

MR. TITCOMB: I accept that amendment.

MR. FULLERTON: We should take the money from the treasury.

MR. MEEHAN: Then the funds solicited should go into the treasury.

MR. FULLERTON: Before the original motion is put I think another clause should be added. The committee should work in harmony with our secretary in regard to this, because a lot of matter will come to him that would not go to the committee.

MR. TITCOMB: I think the committee should have the editing and publication of the transactions.

PRESIDENT: Was not that included in your motion?

MR. TITCOMB: That is intended.

MR. FULLERTON: The secretary should be consulted.

MR. TITCOMB: Of course.

The motion as amended was unanimously passed.

MR. STEVENSON: Before proceeding to the reading of papers, I wish to say that our esteemed secretary is lying critically ill in Chicago, and I move you, sir, that our acting recording secretary be directed to send a telegram of sympathy to Mr. Peabody at the hospital in Chicago.

The motion was seconded and unanimously carried by a rising vote.

MR. TITCOMB: I suggest that the committee on resolutions prepare that resolution.

MR. CLARK: I suggest that it be sent tonight, and under the acting secretary's name.

So agreed.

PRESIDENT: We will now hear the report of the committee on nominations.

ACTING SECRETARY: The chairman of the committee on nominations has requested me to make the following announcement:

For President, Mr. Seymour Bower, Detroit, Michigan.

For Vice-President, Mr. W. E. Meehan, Harrisburg, Pa.

For Recording Secretary, Mr. George F. Peabody, Appleton, Wisconsin.

For Assistant Recording Secretary, Mr. Ward T. Bower, Washington, D. C.

For Corresponding Secretary, Mr. Charles G. Atkins, East Orland, Me.

For Treasurer, Mr. C. W. Willard, Westerly, R. I.

For Executive Committee:

Mr. S. F. Fullerton, St. Paul, Minn., chairman.
Mr. C. H. Stevenson, Washington, D. C.
Mr. C. H. Townsend, New York City.
Mr. G. H. Lambson, Baird, California.
Mr. George T. Mathewson, Thompsonville, Conn.
Mr. Frank Miller, Put-in Bay, Ohio.
Mr. Jabe Alford, Madison, Wisconsin.

MR. CLARK: I move that the report of the committee on nominations be accepted and adopted.

The motion was seconded and unanimously carried.

PRESIDENT: This carries the election of these members.

Mr. Titcomb, chairman of the committee on resolutions, then presented the following telegram to be sent to the secretary. The message was approved and directed to be sent:

MR. GEORGE F. PEABODY,

Presbyterian Hospital, Chicago.

The American Fisheries Society extends sincere sympathy to you, and prays for your speedy recovery.

WARD T. BOWER,
Acting Secretary.

PRESIDENT: The next order of business is the reading of papers, and we will now hear a paper on "Some Details of Salmon Culture," by W. O. Buck, Grand Lake Stream, Me.

Mr. Buck's paper was then read, and was followed by a paper by Mr. John N. Cobb, on "The King Salmon of Alaska," and by a paper by Mr. Seymour Bower, on "The Rainbow Trout in Michigan," all of which, with the discussions, appear in the second part of the proceedings.

MR. POMEROY: We would like to have it understood as to the car. Of course we cannot hold the car, but it will be

ready at 8 o'clock in front of the Secor Hotel and will bring you back here to the house; so if you will all be ready as promptly as possible it will oblige us. We probably can hold it a minute or possibly two minutes, but not much longer. Everything is arranged to change the date from Thursday to Wednesday morning at 8 o'clock.

MR. C. W. WILLARD: Will you instruct us what car to take in case any should be late?

MR. POMEROY: If you will get a Lake Shore Electric time card it will show you what car to take to go through to Sandusky. It is the Sandusky car on the Lake Shore Electric that you must take. I believe that the 9.30 car would take you through, but there will be no trouble at all in getting from the porter in the house a little time card for that road.

MR. WILLARD: At what station do they get off?

MR. POMEROY: Castalia. It is right in our grounds. The car will stop for you there. There will be no difficulty in locating the site, and you get off at the upper part of the grounds. There is a foot bridge across every stretch of water, so that you can walk through to the clubhouse in six or seven minutes, if you chose to come straight, or if you follow either stream you will reach the clubhouse.

The Society then adjourned.

Castalia, Ohio, July 28, 1909.

Meeting called to order by the president at 12 o'clock noon.

PRESIDENT: There are two committees to report, one, the committee on the fortieth anniversary, whose report we will now hear.

MR. W. E. MEEHAN: We were a little embarrassed. There were two propositions made, or rather two invitations extended, one for us to go to New Orleans, and the other to New York. Those who advocated New York did so on the ground that the next meeting would mark the fortieth anni-

versary of the life of this Society. The other invitation from Louisiana was couched in such cordial terms, and the reasons given were so strong, that the committee felt embarrassed, but has finally decided to report in favor of holding the meeting in New York at the Aquarium, to mark the fortieth anniversary, and in the last week in September, beginning on Tuesday. The committee strongly recommends that the Society at its next meeting take action toward having the following annual meeting held at New Orleans, Louisiana.

MR. CLARK: I move that the report of the committee be accepted and adopted.

MR. FULLERTON: Does that include the recommendation for New Orleans?

MR. CLARK: It does, so far as we have power. The Society cannot this year, of course, positively set the time of the meeting for 1911, but it can adopt the committee's recommendation. That does not necessarily put the meeting in New Orleans.

MR. MEEHAN: We simply recommend that the place be considered next year.

The motion was unanimously carried.

MR. MEEHAN: I think we should like to hear a few words in reference to Louisiana.

MR. FRANK M. MILLER: Not much more can be said by me than what has been so eloquently said by the distinguished chairman of the committee. I think myself that the time has come for the American Fisheries Society to be true to its name. Here you are a lot of eastern, northern and western men. Probably Mr. Burnham and myself are the only southern men here. The south is a great country, increasing enormously in its resources, and it has been neglected by the rest of the country; but we are now waking up to the fact that we are a part of you, and we want brotherhood with you that we may secure our common ideal of making this the greatest country on the face of the earth. (Great applause.)

Our state is now waking up to the fact that the natural resources which we possess in great quantities have been shamefully abused. This is the first year that we have ever had any restraining hand upon our people, and some of them don't like it. But nevertheless, the natural resources of the State of Louisiana are almost fabulous, and we want you to come down and see them.

As far as fish are concerned, with singular fatuity we have turned over the conservation of the fish to the Dago, the most undesirable citizen we have, a curse to any community. He will eat anything from a mouse to a dog, and from a mocking bird to a buzzard. He has seined the waters of the Gulf with seines that will catch a mosquito, and the fishing industry of our state has been shamefully neglected.

Now, we on the Gulf front have awakened to the fact that something must be done, and we think it should be done through the American Fisheries Society.

If you come down there in 1911 our governor will invite the governors of the other Gulf States to come themselves and send representatives, and we will have a convention worth while. I can assure you that we will give you all a very excellent time.

New Orleans is a beautiful city. It is not an American city; it is somewhat foreign. But nevertheless you ought to see our city, ought to see our state, and I bespeak on the part of the State of Louisiana the most cordial invitation to you to come there to hold your convention in 1911. (Great applause.)

PRESIDENT: Mr. Miller, I do not believe that the members of this Society require any argument to prove what you have said to them, because they know from their own personal observations that the southern waters are richer today in the fish which we love than are the northern waters. The finest fish that take the hook or leap to the fly are in the southern waters; the best oysters that I ever ate I have eaten in New Orleans; and I understand that the little-neck clam also is found within the jurisdiction of the State of Louisiana; and

there isn't any doubt about what can be done with the littleneck clam in Louisiana when Miller and his associates get hold of the problem. I am very glad, indeed, to second the action of this Society as far as I am able to do so. I would like to go to New Orleans again and again.

MR. MILLER: I thank you.

REPORT OF COMMITTEE ON RESOLUTIONS.

PRESIDENT: Is the committee on resolutions ready to report?

MR. TITCOMB: The committee has the honor to report the following resolutions:

RESOLVED, That the thanks of this Society be extended to Mr. John E. Gunckel, of Toledo, Ohio, the friend of the bad boy, the patron of the good fisherman, for the successful manner in which he has dealt with the difficult details connected with holding our convention of 1909, and the Society, in grateful acknowledgment of his efforts, offers to furnish him indefinitely with the underlying facts upon which to base his future literary triumphs in piscatorial narration.

RESOLVED, That the American Fisheries Society, appreciating the pleasure and profit derived from the opportunity of visiting this club house, grounds and trout stream, most heartily thank the Castalia Trout Club, its officers and members, for the privilege of enjoying their hospitality.

WHEREAS, As silently as the clouds obscure the sun and shut out the rays which brighten our days, so does the grim reaper whom, for want of a better name, we call Death, gather his harvest of those whose companionship in the Society has brightened our meeting and whose work has done so much to help along the cause we are all enlisted in. Little is the space that anyone fills in the world, yet it was the labor of such men, whom we will sadly miss, that made possible something which without them we would still be groping for.

RESOLVED, That we shall miss our deceased brothers whose names follow, and in our sorrow we feel for those who were nearer and dearer, to whom we extend our sincerest sympathy:

Walter L. Powell, Harrisburg, Pa.
Westley S. Henry, Park Side, Pa.
Redfield Proctor, United States Senator from Vermont.
R. D. Hume, San Francisco, Cal.
L. D. Huntington, New Rochelle, N. Y.
Alexander Starbuck, Cincinnati, Ohio.

The report of the committee was approved, the first two resolutions being unanimously carried, and the last resolution being adopted by a rising vote.

MR. TITCOMB: The committee offers the following additional resolution:

> There shall be a standing committee of three to be appointed annually by the president, to be known as the editing committee. The committee shall have power to pass upon all papers presented and decide whether they shall be published in the proceedings of the Society, and shall also have power to edit the report of the discussions before publication. The committee shall also have power to edit any paper which it may consider worthy of publication, but which is not in literary form. When the work of the committee is completed the manuscript is to be turned over to the secretary for publication. Any papers rejected are still the property of the Society and are to be filed by the secretary.

If I may be allowed to add a word in this connection: The editing of papers which contain good stuff, as an editor might call it, I think should encourage practical men, and many of us have not had the advantage of a college education. This resolution really should encourage the practical fish culturists to present to us more material than they do today. They hesitate about it now, because they fear that it will not be presented in proper shape. Here they have an opportunity to do it through a committee who will put it in proper shape before it is published.

MR. CLARK: I move the adoption of the resolution.

DR. EVERMANN: I would suggest instead of the name "editing committee" that you call it "committee on publication."

MR. MEEHAN: It is not a committee on publication. The publishing is done by the secretary of the Society. This is purely an editing committee.

DR. EVERMANN: It seems to me the name committee on publication would cover the whole ground. Slips may be made between the secretary and the committee very easily. The committee should consider not only the literary form, but matters of fact and also points of good book-making.

PRESIDENT: I would like to say from my personal ac-

quaintance with editorial work that it is going to be rather difficult to find a committee that will be able to do this work. The secretary has done it heretofore, and every one knows it is not a light matter. However, that will have to be considered in the selection of the committee. It will always be a live proposition to find a committee that will really do the work. It is no very easy matter to get publications in print properly.

MR. SEYMOUR BOWER: Am I to understand that the secretary is to submit the proofs the same as usual, or is the action of the editing committee final? Would authors have no opportunity of making corrections themselves? I think that the proofs, both of the discussions and papers, should be returned to the authors, because this editing committee, while it would polish up and put in nice form, might unwittingly change an idea and convey a wrong impression.

MR. TITCOMB: It is my understanding, after conferring with the other members of the committee, that following the revision the matter would go to the authors, that is, any minutes of discussion, if they are to be edited at all, of course, should be edited before they go to the author or speaker, so that he may have a chance to see whether he has been misrepresented and may make necessary corrections.

PRESIDENT: I of course assume that this committee will act just as any other editor would act, submitting proofs to the authors and incorporating any necessary corrections that they may indicate.

MR. MEEHAN: That is my idea—it should naturally go back to the author.

The resolution as amended, being acceptable to the committee, was adopted.

PRESIDENT: I will name this committee later.

MR. MEEHAN: I move that we take a recess subject to the call of the president.

This motion prevailed, and a recess was taken until 3.10 p. m., when the meeting was called to order.

PRESIDENT: Before we begin the consideration of the

papers, I will announce the committee on publication: Dr. Hugh M. Smith, chairman; Mr. W. E. Meehan, and Mr. Ward T. Bower. I suppose a committee of three will be large enough.

MR. MEEHAN: Don't you think you had better have all three members men from Washington? I do not say this to shirk work.

PRESIDENT: I wanted to have the benefit of Mr. Meehan's editorial experience. Mr. Meehan has been the editor of an important daily paper for so many years of his life, besides having distinguished himself in other literary fields, that I should be sorry to miss his guidance with this committee; and I name Dr. Smith, because it is through Dr. Smith that this necessity was first brought to the attention of the Society. Then Mr. Bower, being our assistant secretary, would naturally perform the work which would otherwise go to the recording secretary.

MR. MEEHAN: I am ready to do anything that the Society wants me to, but if you had three men in Washington they could work conveniently together.

PRESIDENT: The committee will stand as announced.

I do not know of any other business except the reading of papers. Since the meeting of last evening a paper has been received from Prof. Ward. I will read to you the full list of papers that remain to be considered, and will ask you to decide which of them shall be read:

Dr. S. P. Bartlett, The Future of the Carp.

Mr. John L. Leary, The Propagation of Crappie and Catfish.

Mr. Felix A. Laumen, Some Essentials in Pond Culture.

Mr. S. G. Worth, Progress in Hatching Striped Bass.

Mr. G. H. Thomson, Protection of the Undersized Trout.

Prof. H. B. Ward, The Leaping of the Alaska Salmon.

Mr. A. Kelly Evans, The Awakening of Public Interest in the Improvement of the Fisheries of the Province of Ontario.

This last paper, by the way, has not yet been received, and

consequently cannot be considered, except that we might have a vote to publish it if received in time for publication. The first paper on the list is Dr. Bartlett's, the next Mr. Leary's, the next Mr. Laumen's, followed by Mr. Worth, Mr. Thomson and Prof. Ward.

MR. CLARK: I move that we take up the questions in relation to pond culture, and the papers in that line first.

The motion was adopted. The first paper on pond culture being that of Mr. Leary, it was read by the assistant secretary and was discussed. The paper by Mr. Laumen was next read by the assistant secretary. These papers appear in the second part of the proceedings.

PRESIDENT: The only papers remaining on the program are those by Dr. Bartlett, Mr. Worth, Mr. Thomson, and Professor Ward.

MR. CLARK: I move that the remainder of the papers be read by title, and considered read and be published in the proceedings.

The motion was carried.

The Question Box was then taken up. The questions considered and discussed will be found at the end of the papers and discussions.

MR. CLARK: Mr. Brown, of the club, has requested me to ask when it is desired that the special car go back. It can go back any time that the Society sees fit.

PRESIDENT: I cannot see any reason why our proceedings should not be finished by 4.30. It appears that we can finish the Question Box, install the new officers, and do all that remains to be done by 4.30.

MR. CLARK: Then I will tell Mr. Brown that is the wish of the Society.

PRESIDENT: I take this opportunity to thank you for having endured my ministrations during the past year. One of the greatest pleasures after taking up a responsibility is laying it down, which I do with great cheerfulness under the circumstances, because I know that my old and esteemed friend, Mr. Seymour Bower, will take up the work and

prosecute it with greater vigor and no doubt more discretion than I have been able to exercise. It was said by a very eminent humorous poet that

> Men dying make their wills,
> But wives escape the work so sad;
> Why should they make what all their lives
> The gentle things have always had?

Speaking about dying, which, of course, the present officers are about to do, some of us have an old western feeling that if we must die we prefer to die with our boots on. Now, thanks to the generosity and kindness of our treasurer, who is not here, I am able to die with my boots on. You can see for yourselves. (Laughter.) (The president here referred to a pair of toy rubber boots.)

I now have the pleasure of asking Mr. Clark to induct the president-elect to the chair.

MR. CLARK: Mr. President, as long as 29 years ago, when our late Professor Baird, the founder of the fish-cultural work of the national fish commission, asked me to take hold of the work in Michigan, plans were formed for taking it up permanently at Northville. At that time we had diseases among our fish, and I made up my mind that we must have some one connected with that work who would be able to doctor them. Knowing that the United States Fish Commission at that time did not have money enough to employ a trained physician, I looked about for the next best man to help me, and I engaged a druggist, Mr. Bower, to help start the work at Northville 29 years ago the first of September, and from that time on he has done practically nothing but fish-cultural work. I do not wish to take the credit. I simply picked him out as a fish doctor; but, Mr. President and gentlemen of the Society, I builded better than I knew. He was not a fish doctor, but he has turned out to be one of the best fish-culturists in the world today. (Great applause.) And I now take pleasure, Mr. President, not in introducing him, but in inducting Mr. Bower to the office

and chair of the presidency of the greatest society, to my mind, in the world, the first state superintendent (I think I speak advisedly) ever elected to preside over the American Fisheries Society. Mr. Seymour Bower, gentlemen. (Great applause.)

REMARKS OF NEWLY ELECTED OFFICERS.

MR. SEYMOUR BOWER: Mr. President, and gentlemen of the Society, if I would ordinarily feel greatly embarrassed on an occasion of this kind, I certainly feel doubly so after what Dr. Bean and Mr. Clark have said. I feel so embarrassed, in fact, that I heartily wish that this part of the program might be omitted. I am free to say that I do not enjoy this stage of the proceedings even a little bit, because I am not built that way, and yet I do want to thank each and every member sincerely and feelingly for the expression of confidence conveyed in your choice of an official leader for the ensuing year.

During my life I have belonged to, or rather have been identified with, several orders and organizations, but I can truthfully say that the one that I have learned to love better than any other is the American Fisheries Society, not because I have had the honor of serving as your secretary, nor yet the still greater honor of today, but because my relations with the Society have brought me into contact with some of the salt of the earth, and have made for me some of the strongest and best and most enduring frienships of my life.

I joined this Society some 18 or 20 years ago, and have attended nearly every one of the meetings since that time. I have been present at a meeting when the total enrollment did not exceed 15. I have seen the Society on the rocks financially, and when the future looked none too bright, but thanks to the loyalty and persistency of the old guard, and the hearty cooperation of the United States Fish Commission, now known as the Bureau of Fisheries, and the boards of commissioners of the several states, and last but by no

means least, to having the best treasurer that this or any other Society ever had (applause), we are today, I believe on a surer basis and sounder foundation than we ever were before; and I believe we are going to continue to grow in numbers, strength and influence.

Gentlemen, if there were any doubt as to my appreciation of the high honor you have conferred, I have only to point to the long roll of able and distinguished men on the list of my predecessors. Referring to only a few who have passed to the great beyond and who have earned a nation-wide reputation by earnestly striving for what we today are striving for, we find in that list the names of Robert B. Roosevelt and Eugene G. Blackford, of New York, Henry L. Ford, of Pennsylvania, Marshall McDonald, of Virginia, and in my judgment, greatest of all, that magnificent man of brains and culture and heart, the noblest Roman of them all, General Bryant, of Wisconsin. (Great applause.)

In the presence of so many ex-presidents, I would ordinarily feel some delicacy in referring to any particular one, and would hesitate to do so, but there is one who, by his many years of unpaid and unselfish devotion to the cause of honest, progressive and scientific fish culture, has endeared himself to every member of this Society. We all know him and know his true worth, and his absence from this meeting is most keenly regretted. I refer to that grizzled old veteran and grand old man whom we all have learned to love, Hon. Henry T. Root, of Rhode Island. (Great applause.)

Just one more moment of your time. I want to urge every single member here to make a special effort to be present at the fortieth anniversary meeting and also to attend as many of the future meetings as possible. Make some personal sacrifice to do so, if necessary, and I want you to come prepared to offer some idea, thought, or suggestion that will be helpful to all of the members, and that will contribute to the common fund of fish-cultural knowledge. We must give and take in this Society; we must be

as willing to teach when we can as we are to learn when we can. We must be as willing to tell others what we know as we are anxious to learn what they know. In short, we must make this Society the great fish-cultural clearing-house for the interchange and taking up of old and new thoughts and ideas. In this way and in standing loyally first, last and all the time by whatever is for the best interests of this Society, may we hope or aim to be, or perhaps I should say continue to be, the one high-class, strongly-organized representative body in our field of endeavor in this country if not in the world. I thank you. (Great applause.)

I think the next thing on the program is to have the vice-president called on the carpet, and I will appoint Dr. Evermann as a committee of one to escort him to the front and put him on the firing line. (Laughter.)

DR. EVERMANN: I am sure we will all be glad to have a word from our worthy vice-president.

VICE-PRESIDENT W. E. MEEHAN: Mr. President and gentlemen, you have done me an honor in electing me your vice-president. I am well aware that it is more of a courtesy position than one of active work. Nevertheless, I deeply appreciate it, and should occasion require my services they will be granted to the best of my ability. I suppose I will have to be simply in the position of the man in the western part of the state. He was not noted for his public spirit or usefulness, and he died with his boots on, as our ex-president aptly put it. Afterwards his friends, or the people, not knowing just what to put on the tombstone, and not wanting to tell any lies about him, carved this inscription:

> He done his damnedest,
> Angels could do no more.

(Laughter and applause).

PRESIDENT: I believe this Society would like to hear a word from our newly elected treasurer.

TREASURER C. W. WILLARD: I wish I could find words to express my feelings, but up to the present time, and I have

been treasurer of this Society since 1900, which means about 9 years, I have never before been asked to make a speech to you.

PRESIDENT: You have not been used right then.

MR. WILLARD: And I hope it may be the last. I can only say a very few words indeed. I accept this office fully realizing the responsibilities that may possibly be incurred by so doing, with the creation this year of new committees, and an assistant secretary who will have to be paid a salary, and a committee for the anniversary which will come off the next year, and also a salaried editor, which will probably take all the funds we can possibly raise. (Laughter.) However, as I have said several times previously, I will endeavor to raise sufficient funds. If they cannot be obtained from the members I will take them from my own pocket, and as I have always previously stated, if we find that the Society flourishes and there is a good sum coming into the treasury, I will take half of it and the Society can have the other half. (Great applause and laughter.)

INTERNATIONAL FISHERIES COMMISSION.

PRESIDENT: I understand Dr. Evermann has a word to say about the International Fisheries Commission.

DR. EVERMANN: I thought it might interest the Society to hear a word regarding the present status of the work of the International Fisheries Commission, about which something was said a year ago at the meeting in Washington.

The commission held several meetings after the completion of its field work last year, and made tentative drafts of regulations which it submitted from time to time to the various states that are interested, to the state fish commissioners for those states, and to the fishermen. After receiving the suggestions and recommendations from these various sources, the regulations were revised, and a revised copy was sent out for further criticism. I think as many as four different revisions were sent out from time to time.

As you all know, I think, Mr. S. T. Bastedo, the gentle-

man who was appointed originally as Canadian commissioner, resigned early in the fall, in order to accept a more lucrative position with the Canadian government, and Professor Edward E. Prince was selected to succeed him. The commission as thus constituted met in Washington, D. C., in June, held a number of conferences, and finally made its report to the respective governments on the 3rd of June last.

Following the recommendations of the State Department and of the Department of Marine and Fisheries of Canada, a number of matters which ordinarily would seem proper to have been included in the report were not included. Many matters in the report as it has been finally submitted, or many matters that might have been in it, have been omitted, and have been left to the respective states.

The report, as I say, was filed with the Secretary of State on the 3rd of June, and with the Canadian government on the same date. The report has not been promulgated by our government and will not be until Congress meets in December, when it will doubtless go to Congress in a message from the President, and go to the Canadian government at the same time. The recommendations in the report, I think, are known in a general way to the commissioners of the various states interested, and to the fishing interests along the line on both sides; but of course the report as a report will not be given out until it is made public by the President and by the proper authorities in Canada.

While the report may not contain everything which some of us think it should contain, it will doubtless serve as a beginning, as an entering wedge, which will work toward the solution of all of the difficult questions pertaining to the international waters.

It is interesting to call attention to the fact that there is growing up in Congress a very strong sentiment in favor of federal control of interstate waters. That feeling has been engendered and has been strengthened from two sources or because of two conditions—one the condition of the fisheries

in the streams in interstate waters, which cannot be controlled by any individual state, and the other the problem of pollution and public health. Take the Ohio River, for instance, or the Potomac or the Mississippi—no one state is able to control the fisheries or the waters of these rivers. So in order to secure proper control of the fisheries, federal control is suggested. A very potent factor is that pertaining to public health. George Shiras 3rd puts it very properly, it seems to me, when he says that if the matter reaches the supreme court it will uphold any decision on that line: that the federal government properly has jurisdiction over all interstate waters in so far as navigation, fisheries, and public health are concerned. Thus if it should ever come about you can see that the question of pollution of interstate streams becomes an easy one to handle, just as Pennsylvania is now handling the question, but it perhaps can not be controlled on the New Jersey side.

MR. MEEHAN: We have passed some concurrent laws with New Jersey.

DR. EVERMANN: Well, that is good. One result of the agitation for better control of interstate waters has been an effort on the part of the states concerned to get together and enact concurrent legislation. This has been particularly noticeable in the Columbia River region, where Oregon, Washington, and Idaho have been making a very heroic effort to enact concurrent legislation which will protect properly the fisheries of the Columbia River. Of course it makes no difference how the thing is brought about. The federal government will be just as well satisfied if Oregon and Washington can control the Columbia River properly as if they should fail to do so and leave it to the federal government eventually.

But the hopeful outlook is this, that through agitation of the question adequate control of interstate streams will be brought about in the not very distant future. Whether it will be exercised by the state or federal government is a matter of secondary consideration. (Great applause.)

MR. MEEHAN: It is a source of satisfaction to me, at least, to hear that Congress is considering the question of taking charge of streams forming boundary lines between different states, even if it does not do it in the long run, because I believe it will bring about more concurrent laws. The very idea that Congress might do that brought about the concurrent laws between the states of New Jersey and Pennsylvania. The New Jersey legislature was not at all eager in the matter, until it was intimated by the commission appointed by the legislature of Pennsylvania that if they did not do something the United States possibly would step in; whereupon concurrent laws were passed and a section with reference to pollution, similar to that of interior waters, was adopted. Fishery regulations were also adopted. I cannot say that I think the fishery regulations are the very best, but they are now far better than before.

One of the great difficulties we have at present is with reference to Delaware and New Jersey, which have locked horns on the proposition of concurrent legislation. New Jersey wishes to have the same concurrent laws passed between it and Delaware that now exist between Pennsylvania and New Jersey. But little success has attended these efforts, and New Jersey has appealed to Pennsylvania. We are going to Delaware with a special commission, and we will put it strongly to them that it is the only thing to do to prevent going to the national government. A suggestion of this kind will probably prove quite efficacious, not only with reference to Delaware but other states similarly situated.

DR. EVERMANN: It is quite interesting to know that a senator from Nebraska wrote to the Bureau of Fisheries that he was ready to introduce a bill providing for federal control of interstate waters, if the Bureau would sanction it and give him suggestions regarding the form of the bill. Of course the Bureau expressed its gratification, but stated that definite measures were not yet ready.

The international commissioners, Dr. Jordan and Prof.

Prince, are now visiting the fishing sections in the west, in the Puget Sound region. Since the middle of June they have been over lakes Erie, Huron and Superior getting suggestions and ideas from the fishermen and the fishery officials along the line. I expect to spend the next six weeks in Passamaquoddy Bay for the same purpose. I also hope to visit Lake Erie in the fall and meet Professor Prince to get the views of the people concerned. In these cases the fishermen and others are given an opportunity to see what the proposed regulations are, and at the same time their suggestions and criticisms are invited.

PRESIDENT: I would like to ask if the chairman of the resolutions committee or any other chairman has any further business to present?

MR. TITCOMB: The committee on resolutions wishes to offer the following:

WHEREAS, the State of Ohio, in conjunction with the States of Pennsylvania, Michigan, Illinois, and Wisconsin, has inaugurated in behalf of an historical and educational exposition at Put-in Bay Island in the year 1913, in commemoration of the one hundredth anniversary of the Battle of Lake Erie; and

WHEREAS, the said states have enacted legislation favorable to this enterprise and authorizing the appointment of commissioners to promote it; and

WHEREAS, it is proposed to hold a fisheries exhibit in connection with the proposed exposition under the auspices of the State of Ohio and the national government,

THEREFORE, BE IT RESOLVED, by the American Fisheries Society, that we cordially endorse the proposed exposition with reference to both its historical and scientific importance, but especially in regard to the opportunity it will present for the promotion of the fisheries interests of the Great Lakes; and we commend to the national authorities the suggestion of their co-operation in the project by means of an adequate fisheries exhibit under the direction of the United States Government.

The resolution was approved.

PRESIDENT: If there is no other business to come before the Society, the chair will entertain a motion to adjourn.

MR. CLARK: I would like to ask the assistant secretary to

be careful that all the various amendments to our constitution are included in the forthcoming printed report.

DR. BEAN: I would suggest further that the papers presented at these meetings be referred to the committee on publication. They are in the hands of the official stenographer, and some action should be taken with reference to the transfer of the papers to the committee on publication.

PRESIDENT: Should he not also transfer with the papers the transcript of his notes?

MR. CLARK: I move that the matter be referred to the incoming officers, or the president, vice-president and chairman of the executive committee. They can arrange with the stenographer.

PRESIDENT: The motion, as I understand it, is that the incoming officers are authorized to direct the stenographer to refer all of the papers and the transcript of his notes to the publication committee. Is that the motion?

MR. CLARK: Yes.

The motion, being seconded, was unanimously carried.

MR. MEEHAN: I move that we adjourn *sine die.*

The motion prevailed.

PRESIDENT: The thirty-ninth meeting of the American Fisheries Society is adjourned *sine die.*

In Memoriam

WESTLEY S. HENRY

R. D. HUME

L. D. HUNTINGTON

WALTER L. POWELL

GEORGE F. PEABODY

REDFIELD PROCTOR

ALEXANDER STARBUCK

MEMORIAL

George Frederick Peabody.

It is with profound sorrow that a record is made of the death of George Frederick Peabody, Secretary of this Society. Prepared though the members were by the announcement at the Toledo meeting of his serious illness and the operation which was rendered necessary thereby, the weight of the calamity caused by the announcement of his passing away on Sunday, September 12, 1909, was in nowise lessened.

To the members of the American Fisheries Society he was more than a faithful, conscientious officer; more than a prominent citizen of Wisconsin; more than a state fish commissioner; he was a personal friend to every member; he had endeared himself to all by his uniform courtesy, sympathy and kindly disposition. When he attended the meeting of the Society in Washington in 1908, and when most of the members saw him for the last time, there was no outward indication that he was suffering from a fatal malady, and, indeed, he himself was seemingly unaware of anything of the kind until within a few weeks of his death.

The American Fisheries Society has lost one of its most faithful officers, one of its most active and enthusiastic members; the State of Wisconsin and the City of Appleton have lost one of their most prominent citizens.

Mr. Peabody's life is a shining example of American citizenship, of sterling American worth, and of American ideals of duty to mankind. He was a native of Connecticut, born in Milford, September 12, 1845. His death, therefore, occurred on the anniversary of his sixty-fourth birthday. He removed when a boy with his parents to Portage, Wisconsin, where he received his early education, and before attaining his majority, entered the employment of C. J. Pettibone, who conducted a dry goods, boot and shoe store at Fond du Lac.

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He displayed such remarkable business aptitude that in 1872 he was sent to Appleton and made manager of Mr. Pettibone's dry goods store in that city. Under his management the business so expanded that it was transformed to an incorporated company with Mr. Peabody as its president.

He took a deep interest in educational affairs, and an active part in the advancement of the Lawrence (Wisconsin) University. He was a member of the board of trustees of that institution from 1896, and contributed generously to its different funds. He built and presented to it a handsome building as a conservatory of music, and was the founder of a prize to be competed for annually by students in Latin.

Mr. Peabody was an enthusiastic sportsman, devoted particularly to yachting, shooting and fishing, and was a prominent member in many clubs and organizations having these as prominent features. Governor George W. Peck appointed him a Commissioner of Fisheries in 1893 and he served six years. During his incumbency he aided materially in advancing Wisconsin among the foremost States engaged in fish culture. Becoming a member of the American Fisheries Society, he was elected its President in 1898. He was elected Secretary in 1901 and was re-elected annually thereafter. As Secretary he shared with the Treasurer, the President and the Chairman of the Executive Committee, the burden of the work of the Society between and during meetings. Indeed, his share was greater, for he took upon his hands the preparation and publication of the Transactions of the Society. His work is indelibly stamped on the history of the American Fisheries Society. He aided as few others in its prosperity and advancement. His death is an almost irreparable loss.

WM. E. MEEHAN.

PART II

PAPERS AND DISCUSSIONS

A PLEA FOR THE SYSTEMATIC STUDY OF FISH DISEASES

By Tarleton H. Bean,
STATE FISH CULTURIST, ALBANY, NEW YORK.

It is not my intention in this paper to give a historical account of the origin and growth of fish culture, but rather to call attention to a present condition which appears to me to operate against the perfect and full development of this important arm of the public service.

We may briefly recall certain salient facts, such as the experiments of S. L. Jacobi, who, in 1741, took eggs from the common trout of Europe and fertilized them artificially. He hatched the eggs in wooden troughs with gravel on the bottom, imitating natural conditions as nearly as possible. In 1837 John Shaw was the first to artificially fertilize eggs of the Atlantic salmon in Great Britain; in 1854 Dr. Theodatus Garlick hatched brook trout eggs in Ohio; in 1856 Massachusetts appointed three commissioners, thereby inaugurating the beginning of public fish culture in the United States; in 1857 Carl Muller of New York and Henry Brown of New Haven impregnated whitefish eggs from Lake Ontario, and also tried to propagate the pike perch; in 1864 salmon eggs were sent from Europe to America, and they were hatched in New York City by James B. Johnson; in 1865 codfish eggs were first successfully hatched in Norway; in 1867 the shad hatching box, a floating box with wire bottom and furnished with wooden cleats, so placed as to tip the box at an angle to the current of the water, was invented and put into practical use. In 1868 New York State followed the example of the New England States by establishing a fish commission consisting of Horatio Seymour, Robert B. Roosevelt and Seth Green. These commissioners were appointed on April 22d. In 1870 the very well-known German association called

the Deutscher Fischerei Verein was organized, and in the same year there was formed the American Fish Culturists' Association, now known as the American Fisheries Society. This association was practically founded by Livingston Stone, ably seconded by Robert B. Roosevelt. In 1871 the federal Congress created the U. S. Fish Commission, which is still very actively engaged in fish culture and allied operations, its present name being the U. S. Bureau of Fisheries. The formation of this great establishment was urged by a committee of the American Fish Culturists' Association, as well as by the Fish Commissioners of New York State, and especially by Robert B. Roosevelt.

It may be permissible here to note the fact that fish culture by the States at first related almost exclusively to the culture of brook trout and Atlantic salmon. The Fish Commissioners of New York were the first to inaugurate a wider range of activities, including exchanges of eggs with foreign countries. Most of the states, in fact, nearly all the states, have had fish commissions in operation for a long period of years, and the aggregate of work accomplished by the states is enormously large. The states have also devoted a great deal of time and care to the study of problems in fish culture, with especial reference to improvements in the taking and handling of eggs and the rearing and distribution of young fish of various ages. The federal government plants fish and eggs by the billion. Some of the states will undoubtedly soon reach the billion mark in their total of fish distribution. Wonderful improvements have been made in the apparatus of fish culture, in the construction of ponds and hatcheries, cars, and in the general management of fish cultural work. There is no doubt that in most respects the federal government outranks all other governments in the care and precision attending its labors.

At the same time, every practical fish culturist now present will, I am sure, agree with me that we still lack some things of the utmost importance. For example, we know only too little about the causes and the treatment of the diseases of

fish. Unintentional as well as willful violations of the fish laws of the states might be greatly lessened by means of clearer definitions of the names and terms employed in those laws. A small illustrated pamphlet or book containing descriptions of a popular character and figures of the important food and game fishes would prove extremely valuable in educating the people and explaining the law. Thorough investigation of the animal and plant life of the waters of nearly all the states is greatly needed as a basis for practical work. We have devoted too little time, and consequently have too scant information about the results of fish distribution. We have not gone very fully into a systematic investigation of the habits and the growth even of our common fish; and especially are we helpless in relation to the diseases of varied origin which often sweep away in a few months the entire result of years of patient labor.

In order to illustrate more effectively the condition of affairs to which I refer, I have collated from the catalogues of publications issued by the U. S. Fish Commission and Bureau of Fisheries a list of titles of papers relating particularly to fish diseases. I have added to this list some references to papers which have appeared in publications by states and by private individuals; but I regret to say that the entire showing is pitifully incomplete and meagre. It is true that my time has prevented me from going fully into the bibliography of papers discussing the diseases of fish, but I have gone far enough, I think, to demonstrate the point taken, which is, that we are devoting too little attention to the subjects upon which the very life of our work depends. It is certainly desirable that we consider this matter seriously and endeavor to correct the condition of affairs as speedily and as completely as possible.

An examination of the bibliography of publications which forms a part of this contribution will prove that very little attention has been given by either the federal or the state governments to the study of fish diseases, and the investigation of the habits and growth of fish. You will not find in any

publication known to me in the English language any general account of the epidemics caused by parasites of various kinds or by diseases due to injurious bacteria, which are so abundant in the fresh waters. Whenever a practical fish culturist desires to inform himself on a subject of such grave importance, he must either consult the *Handbuch* of Dr. Bruno Hofer, published in Germany in 1904, or search through the thousands of publications issued in the last half century by federal and state governments, and in the transactions of learned societies. This involves a tax upon the time and intelligence of the fish culturist which he should not be expected to endure.

In the list of papers I have in some cases made an abstract of the author's recommendations. I have done this for the benefit of those fish culturists who have not time to read a mass of literature. I am sorry to have to confess that wherever one may turn for information, he will as a rule soon discover that while the disease may be described in a way, in most cases the cause of the disease and its treatment are either incompletely mentioned, or not mentioned at all.

I am well aware that the number of investigators in this important field is very small, and that nearly all of the men who are qualified to conduct these studies are engaged in other duties which may appear to be more important, and, at the same time, more remunerative to the investigator. This is a matter which should not be lightly considered or wrongly considered. The laborer is worthy of his hire, and if he cannot secure the returns so essential for his welfare in one direction, he is in duty bound to seek another field giving promise of suitable reward. Our scientific men associated with the study of the culture of the animal and plant life of the waters are very busy with their investigations in fields near and remote, and their work is winning well-merited applause at home and abroad. They are laboring under one of the greatest difficulties which attends scientific work, namely, scant appropriations. It seems to me perfectly proper to state that the allotment for scientific inquiry in general is in-

significant, compared with the economic value of the researches coming within the scope of this division. I would respectfully suggest that the amount of money made available annually for such investigations be greatly increased, and that the program of the work be made to include more extended studies of the same character as those engaged in by such bacteriologists and pathologists as are mentioned in the bibliography hereto attached. Any fish culturist present can readily suggest subjects of study, and all fish culturists will be grateful for the information which is sure to result from these activities.

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Refers to white spots on eggs, apparently vegetable parasites; white spots in the sac, an uncontrollable disease. Salt and mud were tried as remedies, but without permanent benefit. Fungus (*Saprolegnia*) attacks eggs and fish. Salt bath for the fry was beneficial. Artificial shade might also be helpful.

TARLETON H. BEAN.—Fish Diseases. Twelfth Ann. Rep. N. Y. F. F. & G. Com., pp. 129-130 and pp. 131-142, 1907.

Describes an undetermined bacterial disease which destroys the eyes of trout perch, yellow perch, black bass and other fish of immature age. Translations are given from the German of Dr. Hofer on the ulcer disease of the brown trout, the spot disease of the brook trout, the red plague of the carp-like fishes, the scale disease of the whitefishes such as ide, rudd and carp, and the red plague of the eel. The above also issued as a separate in which the notes appear on pp. 52-53 and 54-65. See also the Thirteenth Ann. Rep. of the same commission pp. 112 and 124-125, or the author's separate, pp. 39 and 51-52, 1908.

GARY N. CALKINS.—Report upon the recent epidemic among brook trout (*Salvelinus fontinalis*) on Long Island. Fourth Ann. Rep. N. Y. F. F. & G. Comm. for 1898, pp. 175-190, pl. i-viii, figs. 1-7.

A very clear and valuable account of this parasitic disease, due to *Lymphosporidium truttæ*, a sporozoan classed among the most destructive of the fish parasites, causing extremely fatal epidemics among brook trout of all ages. The fish may not be the original host of the parasite. Similar organisms are found in the body cavities of various crustacea (*Daphnia, Gammarus, Cypris* several species). The trout may swallow the form containing this protozoan. Recommends the destruction of all diseased fish by burial or burning, draining the ponds and exposing them to the sun for a few months, scrubbing the runways and removing all growths; avoid interbreeding with the diseased fish, keep the water perfectly clean and cold, sustain the vitality of the fish, watching for and removing fungoid growths, avoid constant interbreeding by frequently introducing new blood, inspect the food carefully and do not allow it to stand exposed to flies and other insects but have it fresh.

FRANK N. CLARK.—Lake trout diseases. Manual of Fish Culture, U. S. F. C., 1900, p. 105.

The diseases are the same as in all other trout. The causes are impure water, poor food, and injuries received. Salt and swamp earth are used in treatment.

G. P. CLINTON.—Observations and experiments on saprolegnia infesting fish. Bull. U. S. F. C., xiii, 1893, pp. 163-172, 1894.

M. G. CRAFT.—Brown trout disease. Eleventh Ann. Rep. F. F. & G. Comm. N. Y., 1906, pp. 115-116.

HENRY DAVIDSON.—Brown trout disease. Eleventh Ann. Rep. F. F. & G. Comm. N. Y., 1906, pp. 113-114.

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S. A. FORBES.—Preliminary report on the invertebrate animals inhabiting Lakes Geneva and Mendota, Wis., with an account of the fish epidemic in Lake Mendota in 1884. Bull. U. S. F. C. viii, 1888, pp. 473-487, pl. lxxii-lxxiv, 1890.

F. P. GORHAM.—The gas-bubble disease of fish and its cause. Bull. U. S. F. C., xix, 1899, pp. 33-37, pl. 12, 1900.

LOREN W. GREEN.—On a disease affecting the rainbow trout at McCloud River Station. Bull. U. S. F. C., v, 1885, p. 742, 1885.

R. R. GURLEY.—On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes. Bull. U. S. F. C., xi, 1891, pp. 407-420, 1893.

R. R. GURLEY.—The Myxosporidia or psorosperms of fishes, and the epidemics produced by them. Rep. U. S. F. C., xviii, 1892, pp. 65-304, pl. 1-47, 1894.

BRUNO HOFER.—Handbuch der Fischkrankheiten. With 18 color plates and 222 text figures, pp. xv, 369. Munich, 1904.

This valuable synopsis contains numerous descriptions of diseases affecting fishes of the United States some of which have been introduced into Europe, and also European fishes which have been acclimated in our country. The book contains chapters on furunculosis or ulcer disease, the red plague of the carp-like fishes, the red plague of the eel, the salmon pest, the yellow plague of the redeye, or so-called pearl roach of New York City lakes, the spot disease of the brook trout, tuberculosis in fishes, smallpox in the carp, together with interesting accounts of the diseases of the skin, the gills, the intestines, the liver, swim-bladder, and the various viscera and organs of the body, the parasites and bacterial affections of many species well known to us as fish culturists. The most striking difficulty encountered in the use of this work arises from the slight knowledge available concerning the origin and treatment of the diseases referred to.

C. KERBERT.—Chromatophagus parasiticus: A contribution to the natural history of parasites. Rep. U. S. F. C., xii, 1884, pp. 1127-1136, pl. i, 1886.

HERBERT M. KNOWLES.—Dead fish on the coast of Rhode Island. Bull. U. S. F. C., vi, 1886, pp. 194-195, 1886.

EDWIN LINTON.—On certain wart-like excrescences occurring on the short minnow (*Cyprinodon variegatus*) due to psorosperms. Bull. U. S. F. C., ix, 1889, pp. 99-102, pl. xxxv, 1891.

EDWIN LINTON.—A contribution to the life-history of *Dibothrium cordiceps*, Leidy, a parasite infesting the trout of Yellowstone Lake. Bull. U. S. F. C., ix, 1889, pp. 337-358, pl. cxvii-cxix, 1891.

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EDWIN LINTON.—A cestode parasite in the flesh of the butterfish. Bull. U. S. B. F., xxvi, 1906, pp. 111-131, pl. i-ii, 1907.

M. C. MARSH.—A more complete description of Bacterium truttæ. Bull. U. S. F. C., xxii, 1902, pp. 411-416, pl. i and ii, 1903.

M. C. MARSH.—The Cold Spring Harbor epidemic among trout. Tenth Ann. Rep. F. F. & G. Comm. N. Y., 1905, pp. 125-139, with one plate.

Ascribes the disease to *Lymphosporidium truttæ* of Calkins. In treatment avoid overcrowding, transfer to much larger quarters with rapid flow of water, and disinfect the ponds with chloride of lime or copper sulphate.

M. C. MARSH.—Brown trout disease at Pleasant Valley Hatchery. Eleventh Ann. Rep. F. F. & G. Comm. N. Y., 1906, pp. 117-118.

Describes this as a bacterial disease caused by *Bacterium truttæ*. The disease is known from Northville and Paris, Mich., and Bayfield, Wis. Recommends transfer to more roomy quarters and heavy water flow. Treatment by copper sulphate is recommended. A very low temperature will prevent *Bacterium truttæ* from growing, say creek water at 43 degrees Fahr. or less.

M. C. MARSH and F. P. GORHAM.—The gas disease in fishes. Rep. U. S. B. F., 1904, pp. 343-376, pl. i-iii, 1905.

W. S. MARSHALL and N. C. GILBERT.—Notes on the food and parasites of some fresh-water fishes from the lakes at Madison, Wis. Rep U. S. B. F., 1904, pp. 513-522, 1905.

FRED MATHER.—Modern fish culture in fresh and salt water. Forest & Stream Pub. Co., 1900, pp. 255-257.

Mather refers very briefly to salmon diseases, and alludes to the fact that the causes which convert the sporadic into the epidemic disease are unknown, and it is doubtful whether preventive measures adopted are worth their cost.

FRED MATHER.—A trout epidemic, etc., Modern Fish Culture, pp. 260-267, 1900.

HUGO MULERTT.—The goldfish and its culture, third edition, Brooklyn, New York, 1902, pp. 129-136.

The diseases named are: asphyxia, treated with salt; tuberculosis, without effective remedy; slime or itch, remedy, table salt with tadpoles and snails to consume surplus food; dropsy, for which there is no good treatment; erysipelas, caused by improper feeding, treated by placing the tanks in sunlight and withholding food for a month.

CHARLES N. PAGE.—Fish diseases. Aquaria, Des Moines, Iowa, 1898, pp. 34-37.

Mentions fungus, to be treated with salt and nitrate of silver; asphyxia, cured by salt, placing the fish in shallow water; consumption, bladder complaint, itch and dropsy.

H. D. PIERCE.—The spawning of blue-fish. An opinion of the cause of mortality of fish in the Gulf of Mexico. Bull. U. S. F. C., iii, 1883, p. 332, 1883.

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CLOUDSLEY RUTTER.—Natural history of the quinnat salmon. A report on investigations in the Sacramento River, 1896-1901, Bull. U. S. F. C., xxii, 1902, pp. 65-141, pl. 10-18, 1903.

JOHN A. RYDER.—On a skin parasite of the cunner (*Ctenolabrus adspersus*). Bull. U. S. F. C., iv, 1884, pp. 37-42, 1884.

MARK SAMUEL.—Goldfish maladies. The Amateur Aquarist, The Baker & Taylor Co., New York, 1894, pp. 42-46.

The maladies named are fungus, treated with salt; consumption, arrested by removal to larger quarters with healthy, growing plants, feeding regularly daily with small earth-worms or beef and fish food alternately; have active tadpoles and snails in the tank; twitters or itch, caused by a parasite allied to *Saprolegnia*, remedied by removing all refuse and adding a few snails and tadpoles until the disease disappears; bladder complaint, aided by removal to a hospital aquarium and reducing the water until it barely covers the top of the dorsal fin; feed the fish as usual, keep the water pure, place the aquarium in a cool room; dropsy, helped by using five to ten drops of digitalis in a gallon of water; partial suffocation, cured by placing in large vessels in little water and adding salt to the water.

GEORGE F. SCRIBA.—Eye disease of yellow perch. Eleventh Ann. Rep. F. F. & G. Comm. N. Y., 1906, p. 113.

GEORGE A. SEAGLE.—Rainbow trout, diseases of fry and adults. Manual of Fish Culture, U. S. F. C., 1900, pp. 77-79.

Treats of gill inflammation and a slimy skin disease, for both of which salt is a remedy. Fungus and blue swelling are discussed, and for these salt baths and sediment from the reservoir proved useful. Dark spots on the body associated with a light spot on the head immediately over the brain were treated with salt. A disease due to foul ponds yielded somewhat to salt and clay. Glassy eggs, probably due to over-retention in the ovaries, could not be remedied.

EUGENE SMITH.—Diseases of fishes. The Home Aquarium, E. P. Dutton & Co., New York, 1902, pp. 182-183.

Mentions parasites among crustacea, worms, protozoa and fungus, recommending that the last be treated with salt and potash permanganate.

CHARLES WARDELL STILES.—Report on a parasitic protozoan observed on fish in the aquarium. Bull. U. S. F. C., xiii, 1893, pp. 173-190, 1894.

A. B. STIRLING.—Notes on the fungus disease affecting salmon. Rep. U. S. F. C., vi, 1878, pp. 525-529, 1880.

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LIVINGSTON STONE.—Mortality of McCloud River salmon in 1881. Bull. U. S. F. C., i, 1881, p. 134, 1881.

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SUNLAND TRIBUNE.—Poisoned water in the Gulf of Mexico. Bull. U. S. F. C., ii, 1882, p. 104, 1882.

VALÉRY-MAYET.—Hatching salmon eggs at Montpelier, France, and trouble with fungus. Bull. U. S. F. C., v. 1885, p. 272, 1885.

S. WALPOLE and T. H. HUXLEY.—Disease among the salmon of many rivers of England and Wales. Bull. U. S. F. C., i, 1881, pp. 429-448 (including fig. 1), 1882.

CHARLES H. WALTERS.—Brook trout disease. Eleventh Ann. Rep. F. F. & G. Comm. N. Y., 1906, pp. 107-108.

JOHN G. WEBB.—The mortality of fish in the Gulf of Mexico. Bull. U. S. F. C., vi, 1886, pp. 11-13, 1886.

DISCUSSION.

MR. SEYMOUR BOWER (in chair): I hope you will all have some comment to make on this interesting paper. The doctor is, perhaps, too modest to start the discussion. We want to hear something from every one present, and also to draw out a great deal more from the doctor. I

feel sure he has much in reserve, and the way to bring it out is to have a free discussion.

PRESIDENT: There is one thing that I would like to add a little later, illustrating the wide spread of diseases which we have constantly to face. In the course of the discussion I would like to read a letter relating to a throat tumor affecting brook trout in California, but I do not think I should give the name of my correspondent.

MR. CHARLES W. BURNHAM: Do you know of any instances where those diseases are communicated to the human race?

PRESIDENT: I have seen newspaper statements to the effect that certain French and German scientists believe and have perhaps so stated, that in Argentina cancer has been transmitted from fish to the human being. I do not know whether these scientists are correctly quoted. Certainly I have seen no statements in scientific papers that cancer in the human being is derived in any way from eating or handling diseased fish. I do not think that any scientist, at least in the United States, is ready to say that thyroid carcinoma in brook trout, and which, by the way, attacks the brown and rainbow also, is communicable to man. I recently talked with one of the foremost students of cancer in the United States, and I know that he will not make such a statement. He is simply trying to study the disease in the fish to discover, if he can, how it is communicated from fish to fish, as it is, of course, very contagious, and what it is in the water (because it is always communicated in water) that introduces the disease into the fish. He begins to think that some of the crustaceans may be at the bottom of the whole trouble, but he has not so expressed himself as yet.

MR. FRANK N. CLARK: This paper is very interesting. Referring to Mr. Burnham's question whether any disease may be transmitted to the human race from fish, I want to say that I saw Mr. M. C. Marsh inoculate himself with the *Bacterium truttae,* which was killing thousands of trout at Northville. He did not hesitate to take the chances, and it did not harm him in any way.

Now, the diseases of fish differ at various places, especially with trout. At Northville, for instance, we can raise brook trout up to fingerlings 2 or 2½, and occasionally to 4 or 5, without any difficulty whatever. By actual count and weight we raised this year 125,000 number 2 fingerling brook trout from 150,000 fry.

On the first of July I had orders from Washington to put 10,000 of these fish in a pond. They were just as nice No. 2 trout as you ever saw. Today, if you will count the live fish there, I guarantee that you will not find 2,000, 80 per cent having died since the first of July.

Now, we want to know what causes it. Why is it that at Northville we can raise trout up to two inches with such excellent results, while Mr. Bassett, at Paw Paw, Michigan, who is raising trout commercially, has great difficulty in growing them to that age or size? When once he gets them past the No. 2 stage he markets 18,000 out of 20,000 at two years old. He told me the other day that he had no difficulty whatever after getting them past the No. 2 stage. At Northville it is just the reverse; we grow them to the No. 2 or 3 stage, and they are then

apparently as healthy as any fish you ever saw. However, when we try to keep them after that time they die off rapidly, probably from the same disease—the *Bacterium truttae*—that Mr. Marsh first discovered at Northville some 8 or 10 years ago. We have had it there ever since, though we thought at one time we were rid of it. The disease has affected fish kept in a large wild or natural pond as well as those in cement ponds. Mr. Marsh made a careful study of the subject at the time, but has since been working on other matters. This is work for the scientist, as the fish culturist already has too many duties, and besides usually lacks special training for such work.

MR. W. E. MEEHAN: What is the general appearance of the disease, and how do the fish act?

MR. CLARK: The trout appear to be all right, when, without any warning or apparent cause, they commence working down to the lower end of the pond, where they may go against the screen or may not. But they dart about in apparent distress and finally die and sink to the bottom. Sometimes but not always a blotch will be seen on them.

I think Mr. Marsh states in his paper that he found in the soil at Northville something on the order of the lockjaw germ, the tetanus bacillus. Of course, the lockjaw germ is in the ground all the time; at least, so I understand. Mr. Marsh thinks that the *Bacterium truttæ* is similarly in the soil at Northville and through it and the action of the water attacks the fish. There seems to be no difference whether the fish are in the head pond where spring water first enters, or farther down in a series of ponds. At Northville the disease has never attacked anything but the brook trout.

MR. W. E. MEEHAN: The remarks of Mr. Clark are very interesting. We had trouble in one of our hatcheries at Bellefonte for three successive years, and it was very similar to what Mr. Clark describes. We had about ten or a dozen ponds located just outside of the hatching house. They were built of concrete—sides and bottoms—so located that only about a foot of water could be carried. In some of the ponds the young fish up to No. 2 fingerlings did first rate, but in others soon after reaching that size they began to die off very rapidly, the action being just about as Mr. Clark describes. They would move around sometimes sluggishly, again a little more rapidly, then toward the outlet of the pond, and sometimes towards the surface, then they would turn over and die. On one occasion we lost 90,000 in a little while. We tried a number of remedies. We covered the bottom of the ponds with gravel, some of them to a depth of six inches. We kept them thoroughly cleaned, scrubbed the sides, salted them and tried every method we could. In some instances the fish would do well in certain ponds, but nothing could be done to save the fish in two of the ponds. When we gave up using these ponds and transferred the fish to ponds having concreted sides, gravel bottom and two and a half feet of water, we had no more trouble. For two years we have had a low death rate among the fingerlings in these deeper ponds. We have occasionally tested the other ponds, but the same trouble has always developed. A curious feature

is that our yearlings do well in any of the ponds, thus adding to the difficulty of solving the problem. The disease occurs only during the summer months, and while the fish range in size from No. 2 to No. 4 fingerlings.

Going to another point in fish disease: At one of the commercial hatcheries in Pennsylvania and also in the ponds of an organization in the State which has a private preserve, there appeared a boil-like disease in the throat, similar to a tumor; and probably one fish out of every 7 or 8 had this disease. I visited the commercial hatchery and found the ponds inexpressibly filthy; some of them had not been cleaned for 10 or 12 years; and in these there was two feet of mud and dirt and filth of all kinds. I recommended the cleaning of the ponds and the construction of new sides. Word was received the other day that the disease had entirely disappeared from the place, giving the idea that this particular disease is caused largely by a filthy condition of the ponds.

MR. JOHN W. TITCOMB: I think possibly this subject of fish diseases is one that we could discuss the entire time that is allotted for these meetings. It seems to me the chief trouble is not in discovering what the disease is, but in finding a remedy; and until we know more about it every fish culturist must keep his place as clean as possible, and thus avoid many diseases which otherwise may creep in.

The disease at Northville, which has been ably written up by Mr. Marsh, is one for which there appears to be no remedy. It may be possible to have an arrangement whereby something can be put into the water, a minute portion of copper sulphate, for instance, to counteract the effect of the bacteria, but it is rather questionable whether this would pay.

The Bureau has given up the idea of propagating brook trout at Northville, or rather of rearing them and carrying a brood stock, although we raise the fish up to a proper size for distribution as fingerlings. We have, however, been experimenting there on the subject of breeding with a view to ascertaining whether it is possible to secure a race of fish which are immune. By attempting to rear 10,000 of these trout to adults, we hope to ascertain whether out of the 10,000 there may be 500 or 1,000 which survive the disease—we would expect them all to have it—and then from these survivors breed a race possibly immune. This is merely an experiment, and though perhaps not of practical value, it may produce some results. The so-called throat disease is being very thoroughly investigated by the Bureau at this time by a specialist well informed on the subject. It is not generally thought by physicians that the disease is transmitted to the human being, at least if the fish is cooked.

An important point to be ascertained is where the fish first get the disease; whether it comes from the feeding of hog's plucks or the plucks of other animals. Possibly it comes from this source. It must be transmitted through the water from one point to another, which emphasizes the desirability of having each pond independently supplied when possible to do so. These problems are being taken up by the

Bureau. We could employ many more men on all these subjects, not only of fish diseases but others which are co-ordinate.

At this time the Bureau is having made analyses of the water supplies of all of its hatcheries. Today no one can tell by an analysis of the water whether it is suitable for supplying a fish-cultural station. We are not even sure that we shall be able to establish a basis of analysis whereby it may be definitely known that the waters will be suitable for fish culture. We know that many hatcheries have been started where the water supply at the time was inhabited by fish. The natural inference, therefore, was that the water would be suitable for fish-cultural purposes. But it often appears that such is not the case when the fish are crowded together under artificial conditions. So far as known, none of these diseases which the fish culturist encounters is the cause of much, if any, mortality among the fish in their natural habitat.

At one station where for twenty years before a hatchery was established the water supply was used for the maintenance of a series of trout ponds for the pleasure of a few sportsmen, the same water supply today will hatch one or two millions of trout, but at the time of sac absorption practically 80 per cent. of them die. Restock that hatchery from another station with sac absorbed fry and it is possible to rear any reasonable number of them to fingerlings.

At another station the water contains a superabundance of air, and this superaeration seems to be as dangerous as the lack of it. The old-time fish-cultural writers who always required that you must locate a hatchery away from the source of a spring and give the water a chance to get into a normal condition, possibly did not realize that they were taking precautions against superaeration as well as deaeration, the one being as important as the other.

The Bureau is making many observations along other lines. The question of fish diseases must be investigated thoroughly, and after we discover what the disease is there is the great difficulty of combating it. In some instances the best way is to give up attempting to propagate fish where the water supply seems to develop a disease like that produced by the *Bacterium truttæ*, for instance.

This emphasizes the necessity of so locating hatcheries that they may be first operated as field stations. If you want to locate a trout hatchery and you see trout in a stream, don't take it for granted that everything is all right. Set up one or two troughs in a tent or shanty at an expense of $100 or $200; put one man at work hatching the eggs; raise the fry to fingerlings, carry them on through for a year—if any doubt arises make it two years—and crowd them as much as you would at any fish-cultural station. In this way mistakes will be avoided and much money saved for the purchase of sites and the construction of buildings and ponds where the conditions are known to be right. (Applause.)

PRESIDENT: Any further remarks on this subject?

I dislike to take so much time of the Society, but really I think I ought to explain my attitude on this question of the investigation of fish diseases. I do not find fault with anybody; I am not here to con-

demn, but to praise. I think the work that has been done by the states and by the Federal Government has been the greatest work ever done, but what I am sure all of us would like to see is continuous, uninterrupted, close study of this subject which is so vital to the results of public fish culture. Why don't the specialists, the pathologists and bacteriologists go on with their studies? Why are they switched off to some work other than that for which they are prepared? The only reason I can see is that the federal government and the state governments will not pay a living wage.

This very throat tumor that you all know about is in California now; perhaps it came from there; we do not know anything about that; it may have come along with the rainbow trout; it may travel with the eggs; it may be that the eggs we are buying from commercial hatcheries are taken from fish which have had this disease, and their progeny will continue to be subject to it, that is to say, they will be prone to it, and more likely than not will suffer from the attacks of these injurious bacteria which may be present in all the waters. We know nothing about it, and I for one wish that the men who are able to investigate and to recommend would go on investigating and recommending until we stop this dreadful loss to the states and the federal government.

Here is a letter from California that I received only recently, about brook trout obtained from the Sisson hatchery, one of the state hatcheries of California. Here the tumor disease has developed, though perhaps not recognized in California before. Would not this seem to indicate that we are sending it out with the eggs, perhaps spreading it broadcast? We cannot afford to rest on our oars, and say, "Oh, that is not our affair." It is my affair, it is your affair. The American Fisheries Society and all fish culturists, in fact, are in duty bound, it seems to me, to ask for information though we may not always get it, but if we keep on asking and investigating we will succeed, just like the story dear old Professor Mason used to tell about the little bird that in time of storm lit on a great ship. There was no land near by, and it took refuge on a mast of the ship, and eventually found its way to the deck, where it was cared for until land was sighted; then it was liberated; and so its poor little life was saved. The moral is (this story is supposed to have been written by a boy of ten) "If you don't get what you want at first, just keep on trying, and you will get it by and by." I think if we keep on urging the matter and show the necessity which we all recognize, we will find an improvement before many years.

MR. CHARLES W. BURNHAM: There are two possible causes for these diseases that I have not heard mentioned. One is the condition of the food. It may be too old or in some other way unfit and thus bring on disease. Another is the quantity of food. Overfeeding may induce disease. Some attention should be given to these points.

THE FISHERY CENSUS OF 1908

By Charles H. Stevenson,
DETROIT, MICHIGAN.

The value of statistical information in regard to the commercial fisheries has long been recognized. As early as the census of 1840, the products of the fisheries formed a subject of inquiry; and they received more or less attention in the censuses of 1850, 1860, 1870, 1880, and 1890.

As the industries of the country developed, the census work became so extensive and complicated that, owing to the temporary character of the organization, it was found impracticable to give necessary attention to the many subjects and to get out the reports in time to have great practical value. Consequently in arranging for the census of 1900, Congress limited the subjects canvassed, the results to be published within a reasonable time. Among the subjects thus omitted was the fisheries.

In the meantime, to supply the well-recognized need for information, the United States Fish Commission had organized a small statistical force, which made a fishery census of a portion of the country each year, covering the entire country in about five or six years. The work of that office affords the most satisfactory figures for the fisheries of the country from its organization in 1888 up to 1905.

The establishment of the permanent Census Bureau at Washington in 1902 resulted in a somewhat radical departure in government statistical work. Placing the Bureau upon a stable basis, equipped for practically continuous work and organized upon a scale sufficiently broad to permit the effective handling of any statistical inquiry, seems to indicate that purely statistical work of every description will be more and more concentrated in this office, which will thus become,

like similar bureaus abroad, the general statistical clearing house of the government.

Recent legislation limits the decennial work of the census to three general topics, namely, population, agriculture, and manufactures, leaving for the intermediate period—for the seven intercensal years—many special subjects of inquiry, prominent among which is a decennial census of the fisheries, which was specially authorized by act of Congress of June 7, 1906.

In view of the fact that in the employ of the Bureau of Fisheries were a number of men well informed in this special field, a plan of co-operation between the two bureaus was authorized and arranged for this decennial census. A further object of this co-operation was to avoid a duplicate canvass in a portion of the country and to insure uniformity in the statistical work of the two bureaus.

This co-operative work affords an excellent illustration of the relationship which doubtless will ultimately be established between the Census and the various technical bureaus of the government, and is another evidence of the advantages which spring from the establishment of the permanent Census Office.

Mention should be made of the very creditable statistical work being done by several of the States through the fish commission boards and other organizations. Michigan, Maine, Massachusetts, Rhode Island, Connecticut, Maryland, Oregon and several other States collect more or less statistical data. It is hoped to extend the co-operative work of the census of the fisheries to these organizations.

In scope this census applies to the commercial fisheries only, that is, all fishing operations conducted for profit—for the sale of the catch; but it does not include the operations of individuals catching fish for their own consumption or for sport. It covers, in addition to all species of fish proper, such products as whales, seals, turtles, shell fish, and sponges, and likewise the pearl fisheries.

In accordance with the general plan the census of the fisheries was inaugurated in February of the present year. About 40 expert employees, skilled in statistical inquiries, including 4 from the Bureau of Fisheries, were assigned to different parts of the country wherever commercial fisheries are presented, on the interior rivers and lakes as well as on the Atlantic and the Pacific coasts, the Gulf of Mexico and the Great Lakes, covering not less than 30,000 miles of shore line. These agents were provided with appropriate schedules to be filled out and signed as far as practicable by each person conducting independent fishing operations. At present the field work is nearly at an end, representing an average of about 4 months work for each of the men employed, or on a basis of 160 months for one man, and the number of schedules received approximates 25,000.

When I suggested to our esteemed secretary the subject of this paper, I entertained the hope that the work would be sufficiently advanced at this time to permit a general exposition of the results. But unfortunately for the purpose of these remarks, the returns for only a few States are now available. These, however, afford some very interesting comparisons.

Probably none of these is more striking than the very great increase in the carp fishery. Ten years ago the total catch of this species throughout the United States approximated six million pounds. According to the present census, the yield in a single State was more than three times this quantity, amounting to 21,342,300 pounds, for which the fishermen received $562,410. In this State, Illinois, the yield of carp in 1894 was reported at 860,330 pounds; in 1899 it was 9,869,499; whereas in 1908 it was more than 24 times as great as in 1894.

The increase in carp elsewhere has been almost as striking. In those States bordering the Missouri River the yield in 1894 was 343,969 pounds; 1899 it was 1,492,625; while in 1908 it increased to 5,351,100 pounds, or nearly 16 times as great as 14 years before. In the Ohio Valley the increase

since 1894 has been about 1,500 per cent. In Minnesota and Wisconsin the increase has been from 6,863 pounds in 1894 to 228,690 in 1899, and to 3,379,400 in 1908, or 49,000 per cent more than in the year first named.

The increase in abundance of carp has not unfavorably affected the yield of the more valuable species, as appears from the returns of the present census. For instance, the yield of black bass in Illinois shows an increase from 96,829 pounds in 1894, to 126,180 in 1889, and to 502,300 pounds in 1908, or more than five times as much as in 1894. In those States bordering the Missouri River, the yield of this species shows an increase from 195,867 pounds in 1894 to 413,100 in 1908. In Tennessee and Kentucky blass bass have increased from 98,195 pounds in 1894 to 184,200 pounds in the census year.

A similar condition exists in the yield of crappie. Illinois shows an increase in this species from 168,280 pounds in 1894 to 356,320 in 1899 and to 1,260,560 pounds in 1908. In the States bordering the lower Mississippi there appears an increase from 298,500 pounds in 1894 to 486,000 pounds in 1899 and to 684,000 pounds in 1908. In those States bordering the Missouri River the yield of crappie has increased from 180,200 pounds in 1894 to 471,000 in 1908.

A similar comparison might be made for bream or sunfish, which shows a corresponding increase; the combined yield in Missouri, Tennessee, Arkansas, and Iowa amounting to 155,000 pounds in 1894, 325,000 in 1899, and 954,000 in 1908, or six times as much as in the year first named.

Probably more interesting to the fish culturist of the Great Lakes is the very large increase in the yield of whitefish, especially in Lake Erie, where the results of the hatching operations are especially striking. The catch of the fleet of vessels at Erie, Pennsylvania, for instance, shows an increase from 53,276 pounds in 1903 to 451,200 pounds in 1908, or nearly nine times as much. The increase of whitefish in Ohio and Michigan has been large, but probably not so great correspondingly as in Pennsylvania.

DISCUSSION.

MR. FRANK N. CLARK: It is very interesting indeed to note these increases. If I remember correctly, we have members of this Society—I think my friend Mr. Fullerton is one of them—who tells us that fish are not increasing.

MR. S. F. FULLERTON: I still claim it for Lake Superior, Lake Michigan and Lake Huron.

MR. CLARK: I am anxious to compare the report for the whole of Lake Erie and Detroit River for the present year with that of previous years, 1894 to 1899 and other years. We have kept a little run of this matter from year to year through the satistical agent of the Michigan Fish Commission. I have some figures that were compiled by him and given to me yesterday. On the American side of the Detroit River, in 1906, there were caught 68,000 pounds of whitefish; 69,000 pounds in 1907, and last year the catch was only 25,000 pounds. Unquestionably the cause of the decrease was due to the extensive dredging operations by the Government near the mouth of the river before and during the fishing season.

The figures for the first district of Michigan above Detroit show an increase, but for the Detroit River alone a decrease; while in Lake Erie and in Lake Michigan there has been a very marked increase. Without doubt the decrease is caused by the blasting referred to, coffer dam construction and other features of the Detroit River channel improvement work. This kept the fish back last year, and it may continue to do so for four or five years. But certainly it is going to be interesting to take Lake Erie and the Detroit River together, and see what the increase is. Then we will know whether we were right in stating that on account of the large number of fish planted the fishing in Lake Erie has increased much more than in the other lakes.

MR. FULLERTON: No one would be more pleased than I to see an increase in the Great Lakes fishing; and I am glad to hear this of Lake Erie and some of the other lakes. But as to conditions on Lake Superior I refer you to the paper I read before this Society three years ago. In 1879 I went to live on the shore of Lake Superior, at Duluth, and know the conditions then existing there in regard to whitefish and trout. Today you have to go 100 miles from Duluth before you can get any trout or whitefish. I was in hopes that some of these statistics would apply to Lake Superior.

MR. CHARLES H. STEVENSON: Unfortunately the figures for Lake Superior, because of the lateness of the season, could not be obtained.

MR. FULLERTON: There is no question but that the fish are disappearing there. I know from personal observation.

One of the noteworthy things shown by Mr. Stevenson's report is the increase of bass and crappie where the carp have increased in the Mississippi River. We gathered some statistics ourselves and found that from the Iowa line to the St. Croix River $750,000 worth of fish, over 80 per cent. carp, were marketed in a single year. In the same territory the bass and crappie have increased along with the carp, which is very gratifying. I have been an enemy of the carp, but am changing

my mind, for I believe that the carp supply food for the bass and crappie.

MR. W. E. MEEHAN: The increase of fish in Lake Erie has not been confined entirely to whitefish. There have been increases in other species, the lake herring for instance. The increase of lake herring has been so great in Lake Erie that at times last summer and fall the dealers could not handle all that were caught. There also has been a marked increase in the blue pike catch of Lake Erie, especially in Pennsylvania waters. According to the fishermen on the Canadian shore opposite Pennsylvania and up to the New York line the same conditions prevail there, viz.: an increased catch of herring, pike and whitefish. There have likewise been marked increases in the catches of game and food fish throughout the state, such as bass, trout and the like. There has been a great increase in the catch of carp in Pennsylvania. I have always been a pronounced enemy of the carp, believing it to be a common, worthless fish, but along with some others must revise my opinion so far as its value for food purposes is concerned. It today ranks, from unofficial figures, about fourth or fifth in value in the state of Pennsylvania. I shall be able to speak more definitely another year as to catches of the various fishes, because a new state law requires that returns be made to the Department of Fisheries of all species of fish taken in the waters of the state.

MR. CLARK: Regarding fishing in Lake Superior, Mr. Harry Marks, who is in immediate charge of the state hatchery at Sault Ste. Marie, informs me that as the result of our hatching whitefish there for a number of years the principal fishermen at Whitefish Point on Lake Superior say that they are taking more whitefish this season than for many years. They report taking more whitefish this year out of seven pound-nets than they did a few years ago from seventy pound-nets; and these fish were all what are called "jumboes" (four-pound fish and upwards). They were nearly all Lake Erie whitefish, too. It is very easy to distinguish the whitefish of Lake Erie from those native to Lake Superior. This condition seems to indicate that whitefish are showing a marked increase at the east end of Lake Superior, whatever the situation may be at the west end.

MR. CHARLES W. BURNHAM: I would like to inquire of Mr. Stevenson whether he considers the increased catch as proof that the number of fish are increasing, or is it due to improved appliances or more fishermen? What is the cause of this increase?

MR. STEVENSON: Of course an increase in apparatus would naturally result in an increased catch, but it is supposed that the fishermen of the interior waters usually prosecute the fisheries as vigorously as their resources will permit.

MR. MEEHAN: There has been no marked increase in the number of fishermen from the port of Erie in the last five years. Conditions are approximately the same, both as regards the number of fishermen and amount of twine used. I can positively say that there has been a large increase in the catch of fish.

EXPERIMENTS IN STURGEON CULTURE

By W. E. Meehan,
COMMISSIONER OF FISHERIES OF PENNSYLVANIA.

A few years ago the legislatures of New Jersey and Pennsylvania made appropriations for co-operative work to propagate the sturgeon in the Delaware river. The United States Government exhibited its deep interest by assigning Mr. Livingstone Stone to assist. Pennsylvania's hatching plant on the Delaware, then at Bristol, was made ready under Mr. Stone's direction. One of the superintendents of the Pennsylvania Fish Commission was placed in charge in the field and experienced fishermen were engaged and overlooked by an employee of the New Jersey Commission who had been himself the owner of a fleet of sturgeon boats.

The first season's work, extending over several weeks, was an utter failure. About two dozen large fish were secured, of both sexes. Some were spent, some had hard eggs or milt. Three or four ripe females were captured but at no time were ripe specimens of both sexes caught near enough together to allow the eggs to be fertilized.

Both states made another effort the next year but with no better success. Later, Pennsylvania tried again alone but without avail. At no time could ripe males and females be obtained at the same time. I understand that the United States Bureau of Fisheries tried elsewhere but with no better success. A despondent letter from the United States Fish Commissioner confirmed me in an opinion that further effort to avert the seemingly inevitable extinction of the sturgeon in the Delaware river would be hopeless.

But an incident at the Torresdale hatchery, Philadelphia, in 1907, revived my hope that perhaps after all discouragement was premature and that there was a possibility that success might be attained. During the shad season of 1906, Mr.

W. H. Safford, then acting Superintendent of the Torresdale hatchery, on a suggestion from me secured 18 short-nosed sturgeon from the shad fishermen and placed them in the yellow perch pond on the hatchery grounds to ascertain how they would do. The fish ranged in size from 18 inches to 2½ feet in length. The pond is about 275 feet long, about 65 feet wide and has an average depth of 5 to 6 feet. It had a muddy bottom and was fed by a small stream which flows through the hatchery grounds and empties into the Delaware. It is also affected by the tide in the river.

The fish were given no food and they had to rely on what they could pick up, yet the following spring they were not only plump and healthy but one of two showed evidence of developing eggs.

At this time Mr. Jerry R. Berkhous had been given permanent charge of the station, and acting under my direction he secured from the fishermen an additional supply of sturgeon, making the number between 80 and 90. An examination showed that the proportion of sexes was over 50 per cent females, at least among those which were far enough advanced towards maturity to make a determination of sex reasonably certain.

The fish were watched carefully and four of the females ripened their eggs, while two males had ripe milt; but as was the case when Pennsylvania, New Jersey and the United States worked together, the two sexes ripened at different times.

During the summer, the sturgeon were fed regularly with liver and corn meal, and grew rapidly. Early in September, 1908, they were transferred from the perch pond to a pond containing white and yellow catfish of mature size. The catfish pond is about 150 by 120 feet and when full of water has a depth of five feet in the kettle and a shelf which shoals to about one foot. The water is supplied by pumping from the Delaware twice a week. For many weeks the sturgeon apparently did as well in their new quarters as they had done in the perch pond. Shortly after the opening of the winter

and the freezing over of the pond, however, there was a sudden change. One day the Superintendent noticed two or three dead sturgeon under the ice and on making an examination he saw a number of others which, though still alive, were evidently in the last throes against the ice in the shoal water. Calling his men he cleared the ice from the pond, drew the seine, and caught all the sturgeon, to find every one either dead or dying.

No satisfactory explanation of this fatality has been evolved. I give the few theories advanced for what they may be worth. One was that they had been driven from the deeper portions, by the more than 700 mature catfish, into the shallower and much colder water of the pond, and that the temperature was too low for their existence. A second was that the entire temperature of the water was too low, there being a difference of about two degrees between the water in the catfish pond and the bottom water of the perch pond. A third was that there was not enough change of water during the low temperature period. Some color was given to the cold water theories by the fact that all the fish still alive when taken from the pond were stiff and with the same appearance as trout kept for any length of time in tanks during very cold weather without vigorous aeration of the water.

When the nets were operated in the river in the spring of 1909 more sturgeon were procured, also of the short-nosed species. This time Mr. Berkhous selected the sexes in the proportion of one-third females and two-thirds males. They were placed in two small ponds where they could be handled easily and gone over each day. On April 9 he found the first ripe female. A few days before he had found several nearly ripe males.

As the female was taken from the water eggs flowed from her without any pressure for a moment and then stopped. On replacing the fish in the water and again removing her, the eggs once more flowed. This fish, which was a little over two feet long, was stripped with the greatest ease, at least of

a portion of her eggs—for it developed that all were not entirely ripe. The eggs were fertilized by the dry method. They were extremely glutinous and numbered about 1,000. Placed in the jar without having been first cleaned, the result was that most of them fungussed and only three or four hatched.

The second ripe female sturgeon was found on April 13th. She was about 2½ feet long and like the first fish did not have all her eggs ripe. As on the first occasion there were several ripe males. The eggs were fertilized as before by the dry method, but immediately after were placed in a pan of muck and water and had to be stirred for more than two hours before they were thoroughly separated. They are extremely glutinous, and although they were extruded easily they issued in small bunches. After they had been worked sufficiently in the muck and water, they were washed thoroughly and found to be non-adhesive unless allowed to lie quietly on each other for some length of time. An examination under the microscope showed them to be covered with protuberances not unlike the spokes on iron jackstraws.

After having been thoroughly cleansed, the eggs to the number of 6,000 were placed in a jar and water turned on to the amount of about one gallon a minute. Even this would not have been sufficient to move the eggs but that it was run in from the second trough above the jar.

The eggs when placed on the battery were of a brown color for about one-half their circumference and a grayish white the other, and during the whole period of incubation there was very little change in the hue. On this account it was difficult to watch the development of the embryo, or to distinguish the good from the bad eggs. When placed on the battery the water temperature was 48 degrees Farenheit, and during the period of incubation it varied between 46 and 54. The eggs hatched on the 26th of April, 13 days after fertilization. The water temperatures from day to day were as follows: April 13, 48; 14th, 46; 15th, 48; 16th, 50; 17th,

54; 18th, 56; 19th, 54; 20th, 50; 21st, 52; 22d, 56; 23d, 54; 24th, 54; 26th, 54.

The eyes showed first on the 19th, six days after fertilization. It was difficult to detect them at this stage owing to the dark color of the eggs. Under the microscope the eyes when they first appeared were light colored but two or three days later darkened considerably and were plainly visible. The shape of the fish was plainly discernible on the 22d, although the outline had been seen several days earlier. The fry emerged from the eggs slowly and instead of rising and floating out into the trough through the lip, sank to the bottom of the jar, where they rested quietly for several days. They were very dark in color and both in hue and general appearance much resembled tadpoles.

The percentage of hatch was very small, only 400 fish being produced from the 6,000 eggs. Mr. Berkhous is of the opinion that this small percentage was not due to failure to fertilize but to cleansing the eggs of the glutinous matter in the muck. From my observations I am in accord with this opinion, for the reason that very few dead eggs appeared within the period when they should, and also from the fact that they fungussed, and fungussed at a low water temperature.

Detection of dead eggs was very difficult on account of the semi-opaque character of the egg itself. It was only by using a microscope that they could readily be distinguished. Under a microscope they showed a white opaque spot.

One of the peculiarities of the work during the period of incubation was the impossibility of siphoning the dead eggs. Instead of becoming light and rising to the top they remained mixed with the others and this may also have had something to do with the death of other live eggs. It would have been possible to separate the good from the bad only by emptying the jar upon a tray and picking them off one by one. The experiment as conducted indicates that better success in hatching could be obtained by using trays instead of jars. In the first place the eggs are so heavy that to move them

requires double the fall of water; in other words, use only every other trough in the battery. In the second place, it is a seeming impossibility to separate the dead from the live eggs by siphoning; and third, the fry go to the bottom of the jar instead of rising and making their way into the trough and thence to the tank.

Mr. Berkhous' experiments were extremely interesting and I regard them as of great value. They do not prove conclusively that the problem of sturgeon culture has been solved. They do not prove that what was done with the short-nosed sturgeon can be done with the common sturgeon. And even if the same methods can be employed with the common sturgeon, this does not prove that the work can be undertaken on a large scale. The experiments nevertheless seem to be in the right direction. Without doubt short-nosed sturgeon can be carried from year to year in ponds 200 or more feet long and proportionately wide and deep, and eggs can be taken safely in sufficient number to warrant fish cultural work. The experiments indicate further that if short-nosed sturgeon can be so carried, the common sturgeon can be carried in larger ponds, its eggs ripened, taken and hatched.

One point, however, seems to be strongly brought out. Even though the fish can be successfully impounded, in order to insure ripe milt and eggs at the same time, there must be a much larger number of males than females kept in stock.

DISCUSSION.

MR. DWIGHT LYDELL, Comstock Park, Michigan: Have you ever used the Seth Green shad hatching box for hatching sturgeon?

MR. MEEHAN: No; but at the time Mr. Stone and others were engaged in the work they used it.

MR. LYDELL: Several years ago we carried on some experiments along this line for the Michigan Fish Commission. We had about 80,000 eggs, and put them in a Seth Green hatching box and hatched out 70 per cent. We found this box very successful for hatching sturgeon.

MR. FRANK N. CLARK: Mr. Meehan says the eggs are very heavy. It might be interesting to know that the sturgeon eggs which the United States Fish Commission collected on the Detroit River 25 years ago were very light.

PRESIDENT: May I remind the members of the fact that many years ago Seth Green hatched sturgeon very successfully in his shad hatching box.

Now, as to the matter of heavy eggs handled on trays, is not this parallel to the method of hatching our muskellunge on Chautauqua Lake? There we begin the work in jars, then transfer the eggs to a tray with perforated wires giving a good circulation of water. They hatch very successfully in this way unless left in the jars too long, when the mortality is quite heavy.

MR. MEEHAN: I am well aware that there has been successful hatching of sturgeon eggs. Mr. Stone himself was successful, as was also Professor Ryder. But the principal point I want to make is that it is not impossible to take and successfully impound the short-nosed sturgeon and hold them until they ripen their eggs and milt. The great problem that confronts us, at least on the Delaware, is to get the two sexes at the same time. It cannot be done, at least so far we have not been able to get them, whether early in the spring or late. Our efforts have therefore been directed towards some method of impounding the fish successfully. So far it has been found impossible to do anything with large sturgeon in crates. We could neither ripen the eggs nor could we successfully hold the fish any length of time in cribs. But the taking of sturgeon either just before they were matured or at maturity, and holding them, was the point that we were trying to work out, and apparently accomplished.

MR. FULLERTON: I would like to ask when you found the fish running—was it only in the spring?

MR. MEEHAN: It was in April. We commenced to get the short-nosed sturgeon almost as soon as the nets were put in the river, the latter part of March.

MR. FULLERTON: The fishermen of the locality in Minnesota furnishing most of the caviar, find ripe sturgeon all the year round, and I wondered if that was the case with you.

MR. MEEHAN: We find ripe eggs in April. But referring to the common sturgeon, when Mr. Livingston Stone was engaged in the work and New Jersey and Pennsylvania operated together, we found in July both ripe sturgeon and hard sturgeon, the latter with fully developed eggs but not yet matured.

PRESIDENT: We must not lose sight of the fact that the lake sturgeon is different from the short-nosed sturgeon of salt water.

MR. FULLERTON: I think Mr. Meehan tried both kinds.

MR. MEEHAN: No, only the kind on the Delaware River. We are now gathering Lake Erie sturgeon and putting them in large ponds. We already have half a dozen fish two or three feet long which have been taken within the past two or three weeks.

NOTES ON THE INCREASE IN SIZE OF FISH OVA AFTER WATER HARDENING

By Ward T. Bower,
U. S. BUREAU OF FISHERIES, WASHINGTON, D. C.

As the result of a privilege extended to me to draw upon the records of the Bureau of Fisheries, it has become possible to bring to your attention for the sake of comparison and analysis observations made from time to time during the past few years by several of the Bureau's station superintendents with reference to increases in the size of fish ova during the period of incubation. The object in submitting these data is to point out the advisability or even necessity of such considerations, and at the same time to stimulate further investigation of the subject.

The expansion of fish eggs during water hardening is of no particular concern to the fish culturist as regards volume other than that receptacles of sufficient capacity be provided. This absorptive period coincides with the adhesive stage, covering the early processes of segmentation, when the eggs are extremely sensitive and should not be handled. It is when this sensitive period is past, and at the time they are ready to place in the hatching equipment, that measurement becomes a matter of importance. Heretofore it has been generally considered that from this stage of development there was little or no further increase in size throughout the period of incubation.

The prevalence of this erroneous idea is rather strikingly evident from the fact that fish culturists in computing the losses, the output of eggs, and the number of fry hatched, have not until recently taken into consideration, or at least made any allowance for, an increase. This was all in favor of the fish culturist's record, but lacked accuracy, as the output of fish was frequently determined by a volume meas-

urement of the eggs in their later stages, with the same standard that was employed near the beginning of the period of incubation. This condition was, of course, somewhat mitigated in those instances where eggs well eyed were transferred to other stations for hatching and a new standard of measurement was adopted at the station receiving them. However, until recently the fact of there being an increase has received little or no recognition, or at least but slight practical application.

During the last few years various tests and measurements have afforded a definite basis for discarding the old theory. We may, in fact, boldly advance the statement that probably most fish eggs increase in size, not only during the early absorptive period but continuously up to the time of hatching. For a number of species this fact has been demonstrated. Rainbow trout eggs have shown, in the tests, practically no increase. But all other species tested have exhibited varying degrees of growth, in the whitefish reaching 15 per cent.

A resumé of the observations made at a number of the Bureau's stations will show the basis of these conclusions.

WHITEFISH.

During the winter of 1906 Superintendent Downing of the government station at Put-in Bay, Ohio, made some very interesting observations as to the increase in size of whitefish eggs. Various lots were counted from time to time and it was quite conclusively demonstrated that the eggs enlarged in size more than 15 per cent. It was further shown that the rate of increase was quite unnoticeable at first, but the older the eggs the more rapidly they grew. In the winter of 1907 the use of the von Bayer gauge and chart showed that green whitefish eggs ran 42,000 to the quart, and eyed eggs 36,000 to the quart, a bulk increase of approximately 14 per cent.

Superintendent Green, of the Cape Vincent, N. Y., station, noted that whitefish eggs increased 3 per cent in size during the month just prior to hatching. This seems to corroborate the observations of Mr. Downing that the increase largely

occurs in the more advanced stages of the period of incubation.

PIKE PERCH.

At the Put-in Bay station Superintendent Downing carefully counted and measured a lot of pike perch eggs 3 days old, and found that they numbered 171,680 to the quart. When fully eyed 13 days later, but 157,024 eggs from this same lot could be placed in a quart measure, thus showing an increase in bulk of over 8 per cent. Since that time tests with the von Bayer gauge showed the pike perch eggs to measure 180,000 per quart when green, and 150,000 when eyed, a bulk increase of over 16 per cent.

Experiments conducted at the Swanton, Vt., station, under the direction of Superintendent Carter, showed such an increase that two measuring scales were adopted—one for green and one for eyed eggs. The latter allowed for an increase of approximately 11 per cent.

CHINOOK SALMON.

Chinook salmon eggs have been reported upon perhaps more in detail than any others. During the past year Superintendent Lambson, of the station at Baird, California, made some very significant tests to determine the growth of the chinook eggs from the time of water hardening until they were well eyed. Mr. Lambson describes his method of making the tests in substance as follows:

On November 10, 1908, 20 dippers of eggs were measured into a hatching basket. The dipper was of 27 ounces capacity, and there were thus 540 ounces of eggs in all. They ran 74½ to the ounce, making 40,230 eggs in the lot. On January 13, 1909, remeasurement showed 575 ounces of eggs, which at the same count per ounce would have made 42,837 eggs. There had been a loss of 1951 eggs while in the basket, which brought the number up to 44,788. The actual increase in bulk, in terms of eggs counted at 74½ to the ounce, was thus about 4,558. That is, there was an increase in bulk equal to that many eggs of the original size, or a trifle over 10 per cent.

Two other tests, made at the same time and under exactly similar conditions, with the same number and size of eggs, showed increases of 12.68 and a trifle over 11.75 per cent. Great care was used, Mr. Lambson states, to have "struck" measure of the dipper in every instance, and the count of eggs, to the ounce also was carefully made.

The same plan of observation was followed at the Battle Creek and Mill Creek, California, stations, with full confirmation of the results obtained at Baird. From six different lots of eggs an average increase in bulk of over 10 per cent was recorded. In one case it ran as high as 16¼ per cent.

LAKE TROUT.

Lake trout eggs have been tested for increase in size at Duluth and at Northville. At Duluth, on November 19, 1907, a quart of green lake trout eggs was selected as nearly as possible for uniformity of size. These eggs were divided into two equal lots one of which was counted and found to contain 2,869. The other lot was placed on a separate tray. Whenever an egg of the first lot died it was removed and replaced by an egg from the second tray. On February 19, when the eye spots were first visible, it was found that only 2,694 eggs were required to fill a pint measure, thus showing an increase in size of 6 per cent. Just before hatching, April 11, the eggs were again measured, but showed no further increase.

Superintendent Clark states that at the Northville station lake trout eggs are found to increase in size from the green stage to just before hatching from 215 to 185 per fluid ounce, i. e., 14 per cent.

BLUEBACK SALMON.

A lot of blueback salmon eggs, according to Superintendent Hancock, of Yes Bay, Alaska, at the completion of water hardening measured 4,416 to the quart. Five weeks later the same eggs measured 4,160 per quart, and at ten weeks of age they had increased approximately 9 per cent,

numbering 4,000 per quart. They were counted and measured in a 32-ounce graduate. Tests since made with the von Bayer scale showed the increase to be considerably less.

BROOK TROUT.

In regard to brook trout eggs the records show an increase of from 2½ to 10 per cent. Measurements made by Superintendent Robinson at the White Sulphur Springs station, West Virginia, gave an average increase of 2½ per cent. These figures are conservative, and it is probable that the increase was somewhat greater, for some of the tests indicated an increase in bulk of 8 per cent up to the time of eyeing. Mr. Robinson is of the opinion that there is not much increase after the eggs are fairly well eyed to the time of hatching. The tests were made both by means of the displacement of water in a graduated glass tube, and by the von Bayer gauge.

At South Chittenden, Vermont, brook trout eggs increased in bulk from 365 to 340 to the ounce, approximately 6 per cent; while at Spearfish, South Dakota, Superintendent Booth recorded a 3 per cent increase, the latter tests being made both by the von Bayer gauge and by actual count of a few ounces taken in a graduate. An increase of 2 per cent or more was noted by Superintendent Dean, at Neosho, Missouri, and a 4 per cent increase was recorded by Superintendent Henshall, of Bozeman, Montana, the latter test being made with the von Bayer gauge. Observations by Superintendent Thompson at Leadville, Colorado, indicated increases varying from 5 to 10 per cent, and while Mr. Thompson was at the Nashua, New Hampshire, station, he recorded an increase of approximately 10 per cent.

LANDLOCKED SALMON.

As to landlocked salmon Superintendent Race of the Green Lake, Maine, station, finds a slight increase during the period of incubation, tests made with the von Bayer gauge showing this to be approximately 1 per cent. Measurements

with a common apothecary's graduate showed no noticeable difference in the size of the eggs.

RAINBOW AND STEELHEAD TROUT.

With a view to ascertaining the increase in the size of rainbow trout eggs, careful measurements were made several times during the period of incubation of a particular lot of eggs at the Manchester, Iowa, station during the winter of 1906. These measurements demonstrated a slight increase from the time of water hardening until the eighteenth day—324 temperature units—and then a slight decrease until the thirty-second day—516 temperature units. It is the opinion of Superintendent Johnson, who made these interesting observations, that there is a slight increase in the size of rainbow eggs from the beginning of segmentation until the eye spot clearly appears, which usually takes place at about 285 temperature units. After this time there is a gradual decrease in size, the egg being slightly smaller at the time of hatching than at the time of fertilization.

Until a development of about 396 temperature units is reached the membrane of the egg is firm, after which it so increases in softness and tenderness that it cannot be handled without danger of breaking. At this period the egg is very susceptible to slight pressure, its own weight when it is taken from the water tending to a pronounced flattening. It is largely as a result of this softening that it loses the uniformly spherical contour of the earlier stages, and becomes more or less elongated and irregular. In the advanced or soft stage the eggs naturally lie very close together when measured in a graduate and this possibly accounts for the apparent slight decrease in the size just before hatching.

In addition to determining results by the ordinary graduate measurement, Mr. Johnson drew his conclusions from a measurement of the bulk of the eggs by water displacement in a graduated glass tube. This method he considers to be much more accurate, especially in its application to this species of eggs.

Superintendent Robinson, of the White Sulphur Springs station, in West Virginia, has made careful tests with a graduated glass pipette vertically placed to determine the water displacement, and finds a slight decrease in the size of rainbow trout eggs during the period of incubation. Superintendent Seagle's measurements, at Wytheville, Virginia, indicated a slight increase—a trifle under 1 per cent—while at Erwin, Tennessee, Mr. Keesecker, using the von Bayer scale, showed about the same slight increase as at Wytheville.

It thus seems to be shown that for practical purposes there is very little or no increase in the size of rainbow trout eggs during the period of incubation. The peculiar character of these eggs at a certain stage, however, makes measurement difficult and suggests the need of further study of the subject.

Steelhead trout eggs have been carefully measured by Superintendent O'Malley, at the Baker Lake, Washington, station, and showed an increase of 9 per cent. A similar increase was observed also at the Bozeman, Montana, station by Dr. Henshall.

LOBSTERS.

Lobster eggs show a greater increase than any of the fish eggs. At the Gloucester, Massachusetts, station Superintendent Corliss noted that between February 6 and May 1 a given lot of lobster eggs increased from 11 to 13½ ounces—over 20 per cent. It is a peculiar fact that a few days before hatching lobster eggs swell to three times their original size. The variation in the size of good lobster eggs, even from the same parent, is often quite remarkable, some being three times as large as others. Superintendent Hahn, of Boothbay Harbor, Maine, states that the increase in bulk during incubation is not so noticeable at his station as Mr. Corliss has found it at Gloucester, but Mr. Hahn's experience shows an increase varying from 5 to 15 per cent.

CONCLUSIONS.

Reviewing the results of the various tests and measurements, we find the following average increases in the size of the several species:

Whitefish	15 per cent
Pike perch	8 and 11 per cent
Chinook salmon	11 per cent
Brook trout	5 to 10 per cent
Blueback salmon	9 per cent
Lake trout	6 to 14 per cent
Landlocked salmon	1 per cent
Rainbow trout	0

Lobster eggs apparently increase in size more than any of the fish eggs tested, the figures being 15 and 20 per cent for the period of incubation exclusive of the final swelling just prior to hatching.

In presenting these figures, preference of course is given to actual count. Measurement by water displacement is doubtless second for accuracy, and is recommended as against the von Bayer gauge, for the reason that the latter depends for its accuracy upon uniformity in the spherical outline of the egg, whereas individual eggs of all species vary in this respect and there is often further variation when the eggs are out of water, due to softness or weakness of the membrane. The graduated scale or stick, applicable only to jars of eggs, and the measurements by weight have not been specially considered here, probably being less accurate than the other methods mentioned. Aside from actual count true determinations would perhaps best be made with a micrometer applied to eggs which have been carefully treated with proper killing fluids, their normal size and shape being thus preserved. This method, however, is not ordinarily within the reach of practical fish culturists.

With due allowance for inexactness, the figures obtained establish one important fact—namely, that after water

hardening there is an increase in the size of certain species of fish eggs so considerable as to call for recognition in practical fish culture. An output of nominally 100,000,000 eyed whitefish eggs, for instance, measured when eyed and computed by the usual standard for green eggs would add 10,000,000 to 15,000,000 to the actual number planted. Reports may thus unwittingly or unintentionally be increased by many millions.

In addition to their practical significance, these percentages suggest the possibility of other interesting developments. The rainbow trout egg, it seems, has peculiarities which, so far as the present data are concerned, removes it from the considerations applicable to the other species tested. Its near relative, the landlocked salmon, shows little increase in size, if any, after water hardening, and further tests may be expected to show closer similarity of characteristics between these two. It would be of interest to know what characters in the eggs control or accompany the varying degrees of expansion. Have the semi-buoyant eggs, which are kept constantly in motion, greater absorptive power than the heavy eggs, which remain practically unmoved during incubation? Is the increase due to absorption of water, or is it perhaps, a physiological growth? Answer to these questions is possibly to be found in biological literature, but in the various authorities I have consulted there is a striking absence of any mention of increase in size of fish eggs after the early segmentation stages. The question is one well worth further investigation.

DISCUSSION.

MR. FRANK N. CLARK: I question a 15 per cent. increase on whitefish, as I do not think the tests of one year sufficient for definite conclusions. I would like to see the investigations carried on for several years. Mr. Downing's experiments, no doubt, covered just the one season of 1906. While we never have made exactly similar tests, I think in measuring with the von Bayer gauge we found about the same number at all times of the season. Notwithstanding Mr. Downing's experiments for one year, I doubt whether it can be established that from the time whitefish eggs are thoroughly water hardened, say when four or five days old, there is this increase in size when they are two or three months old. However with lake trout eggs it must be confessed that our measurements for several years have shown quite an increase.

MR. S. W. DOWNING: If I remember correctly, I made two experiments. The first was by actual count and the second by means of the von Bayer gauge. The results are as stated by Mr. Bower.

MR. CLARK: Both the same season?

MR. DOWNING: Not the same season. The count was made before I knew of the von Bayer measure. I would like to say in summing up Mr. Bower's paper that it looks a little misleading as regards the number of fry we actually put out. The eggs are measured into the hatchery on the higher standard, 42,000 to the quart, but as they increase during incubation the hatching is done on a 36,000 basis. So we plant just as many fry as we say we do.

MR. S. F. FULLERTON: I find that the difference, especially in pike perch eggs, is very noticeable. We have one station where by actual measurement they did not exceed 120,000 to the quart, but at Tower where the fish are all small, not averaging more than a pound and a half, our men counted as many as 185,000 per quart. There was a difference of 65,000 by actual count.

MR. CLARK: Of course that is not exactly the question here. Those eggs were from different waters and taken at different times. The same difference occurs with whitefish, for if I remember correctly it is very noticeable in whitefish eggs taken in upper Lake Michigan. These run only about 30,000 to the quart, being much larger than those from Lake Erie.

MR. FULLERTON: The reason I brought the subject up is that I just asked Mr. Titcomb in regard to the Federal standard for measuring pike perch eggs. It is difficult to fix a definite standard if the other states have had the same experience that Minnesota has.

MR. JOHN W. TITCOMB: At an earlier meeting of the Society I endeavored to point out the value of the von Bayer measure. You cannot make a standard for any of the smaller eggs nor in fact for the larger eggs. It has been my experience that with almost all species there is a variation in the size of eggs between one field and another,

even on different parts of the same lake. In the trout work the eggs from one stream will be very much larger than those from another; likewise early in the season the eggs will be smaller than during the height of the season; and as the season tapers off the eggs are again smaller. There is great lack of uniformity in size. Of course this is not in a way relevant to Mr. Bower's paper on the growth of eggs. It merely emphasizes, as his paper does, the necessity for establishing a standard. If you want to know how many green eggs you get you must establish a standard for each station where eggs are collected. Then if you are going to judge the hatch by the number of eyed eggs on hand, you must establish another standard for each species and field from which the eggs are taken.

Mr. Fullerton spoke about the larger eggs coming from the large sized pike perch, and similarly in that part of the Manual of Fish Culture where Mr. Clark is the authority, it is stated that the larger trout eggs are obtained from large fish. In my personal experience at several field stations I got the smallest trout eggs from the largest fish. They were from trout ranging from two to five pounds in weight and ran 500 to the ounce.

NOTES ON THE YELLOW BASS

By Charles W. Burnham,
U. S. Fisheries Station, Tupelo, Mississippi.

The yellow bass (*Morone interrupta*) is found in the lower Mississippi Valley, and north to Cincinnati, St. Louis and Terre Haute. It is most abundant in such streams as the St. Francis and White rivers in Arkansas, which are noted for their clear water and clean gravelly or sandy bottoms.

Its color is brassy yellow, darker on back, growing lighter on sides and below, with about 7 very distinct black longitudinal lines. Head depressed, eye large, mouth small, back arched, body comparatively long, flesh firm and white.

It is a splendid food and game fish and compares favorably with the black bass. It is often confounded with and resembles the striped bass of salt water, and the white bass of fresh water. In many places it is known as striped bass or barfish.

The average lengths attained by yellow bass under favorable conditions are as follows: 3 weeks old, 1 inch; 6 weeks old, 1½ inches; 3 months old, 3 inches; 8 months old, 6 inches; 1 year old, 8 inches. The adults usually seen weigh from 1 to 2 pounds, but some caught have exceeded a foot in length, and weighed over 5 pounds.

Young yellow bass are as delicate as crappie, and those less than 2 inches long cannot be handled in warm weather without loss, but like crappie the yellow bass successfully withstand a water temperature higher than 90 degrees if not handled.

When seined from the water fingerling yellow bass bend into a semi-circle as if trying to touch head and tail together. In this position they rapidly become rigid or stiff and die

unless promptly placed in water. Upon being returned to the water they soon straighten out and swim around as usual. The adults do not have the tendency to curl up so much as the young fish and struggle more like other species when removed from the water. Yellow bass are very timid and it is necessary to conceal oneself in order to observe them closely.

The spawning season is in April and May, depending largely on the water temperature, the height of the season being from April 15 to May 15. Spawning takes place about midday, on bright calm days when the water temperature ranges from 68 degrees to 72 degrees, in water from 2 to 3 feet deep.

As the spawning time approaches the fish instinctively swim up stream in search of the purest water. Preliminary to spawning they pair off and swim swiftly along side by side, the male about 3 inches away from the female, both appearing to be much excited. When spawning occurs the fish swim very slowly or stop for a few seconds while the eggs and milt are being emitted.

In the act of spawning the female lies partly on her right side with vent toward the male, ejecting the eggs with a tremulous or wavy motion of her entire body. The male does not lie sideways but remains upright beside the female, so that his vent is directly over the eggs as they come from the female. He ejects the milt on the eggs without any perceptible movement of his body except as necessary to maintain his position beside the female. The eggs are not all voided at once, and the fish swim around together during the interval between spawnings, which continue for an hour or more. After spawning the fish usually remain still near the bottom for some time as if resting.

The eggs are not likely to be all matured at once, therefore the spawnings are probably continued on different days as the eggs develop. The eggs are semi-buoyant and slowly sink. Many of them are eaten or smothered, or are unfer-

tilized when they reach the bottom. Thus yellow bass are not so prolific as black bass and other nest-building pond fishes, which deposit their eggs and guard them until hatched. With yellow bass 100 brood fish per acre are necessary for a good output of young fish.

The eggs are very small, being about .03 of an inch in diameter, or from 2,000,000 to 2,500,000 per quart. The period of incubation at a mean water temperature of 70 degrees is from 4 to 6 days, and the yolk sac is absorbed in about 4 days. When first hatched the fry are from ⅛ to 3/16 of an inch in length, colorless and transparent, the first color to appear being the black eye spots.

Owing to the yolk sac the newly hatched fry are far easier to see than those a few days old, because after the yolk sac is nearly asborbed the fry are only ¼ of an inch long, very transparent, and much more slender. Their small size and transparency are doubtless of considerable protection to them.

The movements of the young yellow bass differ from those of young black bass, but both accomplish the same purpose, i. e., protection from being smothered in sediment. The black bass fry swim forward near the bottom in a horizontal position by energetic movements of the caudal fin. The yellow bass fry rise straight toward the surface head first by vigorous movements of the tail, and when their exertions cease turn quickly and sink head first to the bottom without moving the body or fins while descending. Touching bottom they immediately turn and swim upward again, occasionally stopping before reaching the surface. The habit of incessantly swimming up and sinking slowly to the bottom is probably instinctive, and protects the fry from being suffocated if the bottom is muddy.

When first hatched the fry may be seen when they swim up near the surface in water about two feet deep. After 2 or 3 days they drift toward the shores and can be found in water from 1 to 10 inches deep.

About 4 days after hatching the yolk sac is completely absorbed, and the fry have ceased swimming straight up and dropping slowly to the bottom. They now swim slantingly upward and then downward in the same manner, and when they have reached the bottom, instead of instantly starting up again they pick at small particles and remain at the bottom in a horizontal position for several seconds nibbling around in search of food. The fry are now ¼ to 5/16 of an inch long, colorless and transparent, with the exception of the minute black eye spots, and can be seen only by the very closest observation.

After they begin feeding, the fry grow rapidly, reaching a length of one inch in about 3 weeks. They swim around in schools, and grow very uniformly in size, and are therefore not so destructive to each other as are black bass, which fact offsets to some extent the greater productivity of the black bass by reason of its spawning habits.

The natural food of the fry and fingerlings is air and water insects, crustacea, insect larvae, small fishes, and other forms of life found in water. The natural food of the older fish is air and water insects, crawfish, crustacea, frogs, molluscs, small fishes, tadpoles, worms, etc. At the Tupelo, Mississippi, station the adult yellow bass readily ate raw beef hearts, livers, and steaks, cut into strips resembling angle worms. At this station yellow bass are propagated in ponds by natural consort of the sexes, and the fry are reared to fingerlings before being distributed.

Because of their spawning habits and natural inclination to frequent the deeper places, yellow bass thrive best in large bodies of clear pure water. They do not reproduce well in muddy surface water ponds, nor in roily ponds having earth bottoms without gravel or vegetation. That is one of the principal reasons why yellow bass are so abundant in the St. Francis and White rivers, the water being clear and bottoms gravelly or sandy, the eggs are not smothered, and the waters are so extensive that not many of the fry are eaten before they grow large enough to escape from their enemies.

DISCUSSION.

PRESIDENT: You have heard this rather novel description of the yellow bass. Before the general discussion opens I would like to know for a certainty whether Mr. Burnham can say positively that this species reaches a weight of five pounds.

MR. BURNHAM: No; the statement is taken from Jordan & Evermann's work. The largest I have seen personally were about a foot in length and weighed from two to three pounds.

PRESIDENT: The fish in question is very closely related to the common white perch of the east, and both have incredibly small eggs. The maximum weight given seems to me to be above that generally reported, but Dr. Evermann is here and I have no doubt he can give us a statement as to the size of the white perch of the Mississippi region.

DR. BARTON W. EVERMANN, Washington, D. C.: I do not recall now the data which were used in giving the weights named. All I can say is that I think the matter was looked into pretty carefully at the time, and there was fair justification for the conclusion. I never saw one that large myself.

MR. WARD T. BOWER: Mr. Burnham makes the statement that the eggs measure from two million to two and a half million per quart. I believe it would be interesting for the Society to know how he arrives at those figures. It seems rather incredible that the eggs should be so extremely small.

MR. BURNHAM: I have two authorities besides myself. The Manual of Fish Culture in describing the flat fish, I believe, states that the eggs measure 30 to the lineal inch or about 50,000 to the ounce or 1,600,000 to the quart, and the yellow bass eggs are still smaller. They measure 33 1-3 to the lineal inch, therefore my estimate of 2,000,000 to the quart is not excessive. Superintendent Stapleton, of the Mammoth Spring, Arkansas, station, took eggs of this species from the White River for the purpose of hatching them artificially. By the von Bayer gauge and scale he figured them at 2,500,000 to the quart, but I wished to be conservative, so I stated that they ran from 2,000,000 to 2,500,000 per quart.

MR. WARD T. BOWER: Then the matter stands as to whether the von Bayer gauge is a proper instrument for determining the size of the eggs?

MR. BURNHAM: Yes.

MR. BOWER: You based your conclusions on the fact that the eggs were only .03 inch in diameter?

MR. BURNHAM: Yes.

MR. BOWER: In regard to the von Bayer gauge, I believe that adhesive attraction has a great deal to do with the measurement of eggs by that device. If eggs are placed in a little water on a flat surface, on a piece of glass, for instance, they will all run together. Naturally there must be a slight compression. Therefore I question whether the von Bayer gauge is a true index of the diameter of the eggs, particularly those having a soft membrane.

MR. TITCOMB: I think the von Bayer gauge is a pretty good rough measure in the field, and I believe Mr. Burnham is right when he says

that yellow bass eggs will go from two to two and a half million to the quart.

In connection with recent efforts to propagate the white bass in Arkansas, three yellow bass were spawned by hand in the usual way, the eggs being placed in jars. They hatched in five days at a temperature of 50 degrees F. There seems to be no reason why these eggs cannot be artificially taken and hatched in jars. Incidentally at the same place where the yellow bass were spawned by hand, two crappie were stripped and the eggs also hatched in a jar, the period of incubation being the same. They seemed to have many of the characteristics of pike perch eggs, but were not so adhesive, and there was not so much difficulty in handling them. I wish Mr. Lydell would tell us something about the white bass work done by him.

MR. DWIGHT LYDELL: In 1890 I was sent by the Michigan Fish Commission to Wisconsin to experiment in hatching white bass. The eggs were incubated in jars and I had no trouble in getting a hatching percentage of from 35 to 40. However, we experienced great difficulty in taking the adult bass at spawning time. We found places where thousands of them came to the shore early in the morning to spawn, but when seined up we had nothing but male fish. In the evening it seemed that nothing but females came in, so we set gill nets out in 20 feet of water, and nearly all fish caught were ripe females. The eggs were easily fertilized by males caught in the morning, and we had no trouble in hatching them. We figured white bass eggs at one and a half million to the quart. We took about 20,000,000 and had no trouble in transporting part of them to Michigan. We turned some of them over to the Wisconsin Fish Commission and the fry were planted, I think, in Ashland County waters. We operated during the month of June on Lake Minocqua and Lake Mendota, also on Lake Winneconne and the Winneconne River. The fish spawned at a temperature of 62 degrees to 70 degrees F. The records are in the office of the Michigan Fish Commission and will show exactly what we did. We had no trouble in hatching the eggs in jars or in stripping the fish. They were the easiest fish to strip I ever handled. The males resembled yellow perch in that the supply of milt was abundant. As an experiment we seined up several thousand white bass and put them into an enclosure in the creek. This enclosure was about 200 feet long and the full width of the creek, 30 to 40 feet. However, we were unable to take any eggs in this way.

THE ECONOMIC VALUE OF THE SPORTSMAN

By Andrew Price,
MARLINTON, WEST VIRGINIA.

I am glad that I have an opportunity of maintaining before you that, in the severely practical, scientific world to which you belong, the sportsman has the right to exist and that this right does not depend entirely upon the law of fang and claw.

When I joined this honorable body of scientists some years ago, I did not appreciate the high aims of the Society. I fully expected to find here what Isaac Walton calls "brothers of the angle." But I soon found that that arch destroyer of fish would not have been admitted to temples sacred to the life and health of fish and that his writings as to the most deadly lures and methods can only be classed as "murder as a fine art." I found here a society of serious minded men whose whole lives are given to the business of propagating fish and who have little patience with the recreation that poor suffering humanity gains in the pursuit and death of the inhabitants of the waters.

Levity is not encouraged and I find myself to be the sheep-killing dog in the company of shepherds. Better men than myself, however, have made this mistake. At the meeting of the International Congress of Fisheries at Washington last year, a cabinet officer in giving his address of welcome attempted to perpetrate a pun, which was received with a funereal silence which must have been very disconcerting to the gentleman. He turned pale and realized that he had committed a solecism that would return to him in the stilly night as he lay upon his restless pillow in after years. He said that one of our great fishes, the cod, was of so much importance that its name had a national significance, meaning thereby, C. O. D., but the joke was a child of his imagination destined for his express company, for the scientists

there assembled would have nothing to do with it. A pained expression prevailed upon the face of his audience, very much as though an old and venerated pastor had suddenly launched into profanity from the pulpit. The newspapers next day kindly refrained from mentioning the uncanny occurrence, but I venture to say that he will never forget it as long as he lives.

Now, gentlemen of the Society, permit me to say that this preternatural gravity belongs more to the Weather Bureau than it does to you, for your position is too well assured and your work too important to be dispensed with, and I would rather see you when you take these precious vacations from the constant care and supervision of your work, decide to eat, drink and be merry, and not stifle that saving grace of humor, the proud heritage of the American people. If I had my way I would see that the cabinet member was given a Carnegie medal for bravery.

Now I would ask you to give us who fish to forget our troubles, a place in your scheme of life, and an opportunity to be heard in your deliberations.

I believe that it has been definitely settled by Congress, that there is no consumer, or rather that we as a nation are producers, and the consuming part of our lives is but incidental to the main objects. That if there be a class who do not produce, but only consume, they have no rights that the country is bound to respect. Not so with us, who in return for our predatory habits give as much time and help as we are capable of to aid you in your great and important work.

A certain great lawyer of my state, the general counsel of one of the great railroads of the country, who has risen to the top of his profession, was once talking with a young lawyer who had just begun to practice, but who had high ideals. The young lawyer said he hoped that when he became fifty years old to have accomplished much in his profession; that by that time he would be able to fill certain offices of great honor and trust, so that his life would be a success and of great use in the world. The older lawyer said that he also

had made certain definite plans as to his life when he became fifty years of age; that he hoped at that time to have saved enough money to insure him a competence the rest of his life, in which event, he intended to do nothing but fish the rest of his days. The young lawyer looked disgusted.

I am sorry to add that the young lawyer after a few years of strenuous endeavor was called hence to be no more, and the older lawyer has pursued the even tenor of his way and after a hard day's work retires to his den to be with the most elaborate of outfits of fishing tackle, to dream of the good time coming when he can retire from a profession where one sees the worst side of human nature, and engage in his favorite sport, living the calm and contemplative life of the angler.

I very much fear, for the sake of the soul of this man of high ideals, that this good time a-coming will never be reached, for the way to go a-fishing is to do it now, and such a future existence as he plans will be about as hard to come up to as the proverbial rainbow's foot which we have all been trying to find.

Most of us elderly sportsmen, anyway, have most of our fishing in our heads, and when we dream of babbling brooks and the shade of the streams on a summer's day, we lack the power of execution, having the will and not the power to destroy. Theoretically we are fishermen, but most of us have reached that place best described as our anecdotage. We vainly cry: "Give me but a fishing line, and set me on the streams of West Augusta, and I will gather me a bunch of trout, which will lift my bleeding spirit from the dust, and set it free!" We go on with our work, getting farther and farther from the healthy outdoor life, and our brothers of the angle, till an alien turf enfolds us; we die and none can tell them how we died. And yet,

> Perhaps some hoary-headed swain may say,
> Oft have I seen him at the early dawn,
> Brushing with hasty steps the dew away,
> To catch a sucker he had fixed his thoughts upon.
> Oft have I seen him by some sleepy brook,
> Beneath the shade of overhanging trees,

A jug of wine, a fishing pole, a book—
Waiting for nibbles in contented ease.
Oft have I seen him at the set of sun,
Wind slowly home by devious ways at night,
Clasping in ecstacy a sucker one,
And sink to rest before the tavern hove in sight.

But note it is only the hoary-headed swains can tell about this, for the average fisherman sows his wild oats in the days of his youth and as he gets older reforms and only glories in his past wickedness. To hear him talk you would think that he could still make his hand at fishing, but in truth and in fact, most of us old retired fishermen are really frauds, and we lack the time, the inclination, the skill and energy to make a real fisherman. We can very well remember the times when to get the mountain trout we would suffer all the peril and privation of an explorer. We would penetrate the wilderness and reach some rough brawling mountain stream, and sleep out on the hard ground and say we liked it. But with age comes disinclination to rough it, and sleeping on the ground has lost most of its charms. The air which comes over the yard fence and through the window screens has all the ozone that we require, and when we claim that we can still make a hand at fishing, the truth is not in us. We are back numbers when it comes our time to make good.

Perhaps to make this thesis more valuable and convenient as a reference work, we should treat the subject by subdivisions, and we will therefore consider the economic value of the sportsman from the following viewpoints: (1) As a faker; (2) as a spender; (3) as a producer; (4) as a protector.

The faker is generally a sportsman who in his early days was a well-known terror to the game fishes of his habitat. In the winter or at any time when his particular prey is not in season, he is longing for the time to come when all legal bars will be down and he can go a-fishing. At these times, this animal, being provident by nature, lays in great supplies of fishing tackle and spends much time and money. His thoughts and his conversation turn to his favorite sport at all

times and he is a considerable pest to the community. He admits that in recent years he has neglected his fishing shamefully, preferring flowery beds of ease, but he swears by all the big and little fishes that when spring comes again and the fish are on the bite he will do nothing else but fish. The spring time comes and he falls into a curious kind of indolence known as spring fever. He puts off going fishing from day to day and drags through the work at the office. He takes less interest in the talk of fish and hastily admits that he has not wet a line this year. He idles away the summer time and along about three days from the end of the season he makes a wild dash for the fishing grounds.

Arrived there he finds that his hand has lost its cunning. He tears his clothes and breaks his fishing tackle. He dashes his foot against a stone and falls down in the cold water. His bones are soft and he suffers from rheumatism. If he is very, very wicked, he seeks consolation in the flowing bowl. The fish refuse to respond. He gets tired, cold, wet and miserable, and he knows that he is aging. He remembers with regret the summer frittered away in the sordid cares of business. He accuses himself of degenerating from a noble animal to the level of a common work horse. Six days at the office trying to get the better of some other men, and his Sundays passed in slumber in his comfortable pew. He resolves never to neglect his fishing again, but every year the work habit is more securely fastened upon him and he never gets back his lost heritage. He will not admit it however. He will still claim to be a fisherman and any day except in the season, he will boast and brag of his powers. For him, "each year brings less summer cheer, cramps more his ineffectual spring, and something earlier every year, his singing birds take wing." Am I not right in classing this sportsman as a faker?

But contrast this man with the one who never lets business interfere with his fishing. He is after the fish from early to late. He speedily gets used to the hardships of his favorite sport. His face bronzes over and his muscles harden and he

soon becomes strong in body and in mind. He is given the active mind and he can accomplish in fifteen minutes more effectual work than his sluggish adversary is capable of in any time. He is fitted to write a book, paint a picture, try a law suit, perform a marvelous surgical operation, make a fortune, woo a bride, or perform any other great work he sets his mind upon, and when after a hale and hearty old age he winds up his line for the last time, and is gathered to his fathers, they carve upon his tombstone: "His life was fair and level and when death had set him free, he said, 'I see the devil, but he can't get me.' "

We find that this man is a good example of the spender, and as such plays an important part in the scheme of life. Ask any citizen of Maine or Florida, as well as many other delightful countries, and they will tell you that the most important crop which the people work is the tourist crop. His is

> A legion that never was listed,
> It carries no color nor crest,
> But split in a thousand detachments,
> Is breaking the road for the rest.

Legislatures meet in honor of the tourist and railroads bow to his princely will. The city clerk who spends eleven months in a hall bedroom, and who trembles with fear at the frown of the manager, can buy himself a lance-wood fishing rod and travel to some distant fishing ground, and pass as a potentate among the good people he finds living there. I have seen such a scion of city life tip a rich farmer to the extent of a quarter with a lordly air, and the tip was thankfully received and pocketed. That farmer could have bought up a regiment of such men and was an influential man in his county and state. The tourist had here a taste of what it is to belong to the nobility, and though he had to return to the state of slavery into which he had voluntarily sold himself, he could return with a head held high, spurning the ground on which he walked. He could at least have said that he lived. He had also the satisfaction of knowing that he had left that

quarter in a safe place and that it never would do any more harm as a part of the root of all evil.

I have observed the genus tourist, from the days when I have turned an honest penny by supplying him with bait and showing him where to find the fish and catch them, up to the point when being in a strange country and yielding to a propensity to catch fish, I have been classed as a tourist myself, and been considered legitimate prey for anyone who could separate me from my money.

Those tourists who cannot very well afford it, as well as many who can, are very apt to employ a man known in season as a guide. Guides out of season are generally hired men and fellow citizens. Their duty seems to consist in supplying their master's creel, and loafing along the creek. Ever and anon the guide's voice will come floating over the willows: "Have you ketched airy one yet?" And the tourist will shout back: "No, but I had a bite!"

And for such inexperienced idiots the soda mines of the country work day and night to supply him buscuit.

It is not all of fishing, however, to fish. The tourist goes back home with a sunburn that is cheap at any price.

The tourist has a hard time of it. If he does not catch any fish he is classed as a fool for spending his time and money in a vain pursuit and if he catches a lot of fish he is named a fish hog. He is condemned if he does and he is condemned if he does not. Way down in the heart of each one of us, lies a secret belief that all game is made for our particular use and for none other.

The visiting sportsman, being comparatively harmless and easy money, has an economic value that is very great. In a mountain country such as the one in which I live he is of much importance. No protective measure aimed at the summer boarder's sport has a chance of passing a vigilant legislature. We welcome him as a coming guest with a pocket full of money and speed him as a parting guest when he goes without the fine, large, juicy wad of money which he brought into the country.

As a producer the sportsman is rather unreliable. When unexpected company shows on the horizon and the good wife has nothing to set before the guest of high quality, it is considered the proper thing for the man of the house to go out with his rod and return with enough game fishes for a meal —catching ourselves a mess of fish, in other words.

In West Virginia there is a noted family of hunters and fishers known as the Hammonds of Bug Run. Old Jess Hammond was born in Kentucky, and seeing the clouds of war gathering, refugeed to the forks of Williams River in the heart of a great wilderness, there to take up the life of a hunter and fisherman. He told me at one time that thirteen years elapsed without a person other than his family sheltering under his rooftree. He raised a large family of sons, all of whom took to the woods naturally, and they have made themselves the terror to the game and fish of that country. One of the boys threw back to some remote ancestor and is an accomplished fiddler, having even composed some strange, wild airs. To one of these he gave the title of "Hannah Gutting Fish."

At old man Hammond's house was always a store of the products of the wild: jerked venison, smoked bear meat, wild honey, and other things. In season he partook of all the richness of the wilderness. Not the least of these were the wild ramps, a member of the lily family, the most powerful antiscorbutic known. Except in the dead of winter fish could be had for breakfast by catching a mess of trout while the water was heating to make coffee. Williams River ran by his door. All that was needed if fish were desired was to bait a hook, fish the river for a few rods, and breakfast was in hand.

As a compensating provision, however, nature has provided that, while mountain trout are pronounced to be the greatest of all table delicacies, yet the food is so rich that it soon palls upon the appetite and is not desirable as a steady diet. The Hammonds, however, soon found that certain tenderfeet who lived just beyond the fringe of woods would be

willing to trade a pound of rancid western bacon for a pound of mountain trout. This perhaps seemed queer to them but it was nevertheless a fact, and being so, they took advantage of it and after that the trout lived hard. Those slimed disgusting things called trout were eaten with relish by the people of the low lands and in return they would trade, pound for pound, rich, fat, salty bacon. The sportsmen of the state have just succeeded, however, in having a law passed making it unlawful to sell game or fish and the effect upon the Hammonds is watched with considerable interest. Personally we hope to see them turn their faces towards the sinking sun and to keep a-going until they get to a place into which the sun sinks, so far away that they will never prey upon our woods and waters again.

In recent years there has been procured for this stream from the White Sulphur Springs fish hatchery something over a hundred thousand small fish, both rainbow and brook trout, and these fish have thrived and done well, restoring the river to something like its pristine glory. It has been maddening to think of the untutored Hammonds selling these fish pound for pound for western bacon. But we sometimes rise to the occasion and do what is necessary and so the law has been passed. The wise man will either wash his dishes or keep a dog.

In analyzing my subject in the true scientific way of a protector of the game and fish we find what the chemists call a "trace."

The height of his ambition seems to be to take his stand by the fishing water and kill noble game fishes until the slaughter covers him with blood and guts. He drinks strong water and his speech is coarse. Yet to the tender mercies of such as these is left the welfare of the game and fishes. Our legislatures are full of men who never saw a setting of fish eggs and who never set up a single night with a sick fish.

In West Virginia we have just passed through the travail of inaugurating a most stringent and effective protective measure. The laws of this state on the subject were very

meager and inadequate and there was a general demand among the sportsmen of the state for the enactment of such a law as would give relief by making the other man stop catching fish and killing game.

The common run of land owners are always hankering after the Roman law which gave the land owner the absolute title and right to the game and fish found upon his lands. Even if a wounded animal dragged itself upon the land of an old Roman farmer it was the landowner's just as much as though it was a domestic animal. The western barbarians inhabiting England, however, where might made right, placed the title of all wild animals in the king, and he maintained his standing army thereby. When the consumers rose up in their might and forced King John to hold a special session at Runnymede, they got out of him the greatest game and fish law the world has ever seen, called the Magna Charta and Forestry Laws.

There were a few things in the bill about the lives and liberties of his subjects but in those days not so much was thought about these. The great victory was the concessions concerning the game and fish and especially the fishing in the rivers of England. The right to take certain amounts of the food fishes from the rivers was the thing that the barons of that day prized above all others granted to them. But the king kept all the rights in the game and fish not expressly conceded to the people. That is the law of this land. The state holds full title to all the game and fish and has the right to prescribe the conditions under which they may be taken.

More than anything else, I think, the trading of a pound of brook trout for a pound of bacon caused the people to murmur and get ready for another Runnymede. The Governor, who always had a remarkable ear for a groundswell, appointed a commission of killers to draft a protective law for the protection of the game and fish. On this commission was one member who at one time had been a killer but who had suffered a change of heart to the extent at least of being able to enjoy outdoor life in the woods without wanting to

kill all the wild life that was to be found there. The rest of the commissioners turned over to this comparatively kind and humane man the task of drafting the bill, while they went home to overhaul their fishing tackle and guns. While they were thus engaged, oiling up their deadly firearms and whetting their fish hooks, the man in charge went subtly to work and drafted a law which has about put an end to the hunting and fishing in the state, and which will cause the sportsmen to trade their rifles for cameras, and their fishing tackle for sketch books.

A law has been enacted prohibiting the sale of game and fish; no man may hunt and fish on the lands of another without a written permit; no hotel may serve game or fish to its guests; bachelor deer only may be killed; subjects of foreign potentates and powers are barred from their Sunday avocation; all persons must take out a hunter's license; game wardens are made fire wardens and can impress men to fight fires; railroads must not set the woods on fire and must keep the right of way clear; land owners may arrest any trespassers on their lands and bring them into court; the size and number of fish one may take is regulated, and the proud motto of the state, "Mountaineers are ever free," has a hollow and mocking sound. The valued right to fish on Sunday has been taken from many. On the whole the great majority of us sportsmen are like Othello—our occupation gone.

In conclusion I would ask this body of scientists to accord us a place in your scheme of life. We are not so black as we have been painted. So far as our influence and help goes, we are yours to command. We do not often intrude upon your deliberations and if we are often silent in recognizing the value of your great work, believe me, we do not fail to appreciate it. Go on with it, making two fishes grow where one grew before, and the nations of the earth will rise up and call you blessed.

> Give fools their gold, and knaves their power,
> Let fortune's bubbles rise and fall;
> Who plants a tree, or trains a flower,
> Or stocks a stream is more than all.

SOME DETAILS OF SALMON CULTURE

By W. O. Buck,
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The purpose of this paper is to raise questions for discussion rather than to answer them. It may not, however, be out of place by way of introduction to run over briefly the writer's recent experience in the culture of landlocked salmon, even though it should furnish a basis for criticism only.

At Grand Lake Stream wild brood fish are trapped and impounded as they approach the stream from about the middle of September until the end of their run two months later. None are touched until about ready to yield their eggs. Then all on hand are examined and distributed in retaining pens according to condition. The original enclosure is of large extent, good depth, and has an ample flow of water, so that the fish remain in it in apparent perfect condition. When the fish are ready, the eggs are taken and milted by the "dry method," carried to the hatchery and kept on trays till eyed, the dead eggs being picked out under water about every tenth day. When the eggs are eyed they are poured a few times from one pan to another to whiten the unfertilized, which are then picked out. The rest are returned to the trays and held as before until either shipped or nearly ready to hatch. Those retained are then distributed on coarse meshed trays to the troughs in which they are to be hatched and carried through the sac stage. The present season 12,000 were put into a trough about a foot wide and 10½ feet long, the water being 5 inches deep and flowing in at about 5 gallons per minute. The trough-stand is out of doors and tight covers are provided projecting over the edge of the trough so that light is almost wholly excluded.

A dam reaching about an inch above the surface is put into each trough near its head, forming a small pool into which falls the water from the inlet. This dam keeps the fry from getting under the inlet, where they might be injured by the force of the falling water, and also serves to distribute the flow across the width of the trough. A partition screen is put midway in the trough, giving two compartments each containing 6,000 fry.

The troughs remain unbrushed from the time the eggs are laid out to hatch until the sac is gone, dead eggs being picked out daily with tongs, and dead fry with a small fan, by which they can be lifted without touching the others. The fan is made of small wire bent near its middle to form a square about 1½ inches on a side and having threads tied across to form a net, the rest of the wire being twisted together to receive a handle.

As the water grows warm and slime appears the practice of "mudding" is begun. The earth employed is a fine sandy loam, which is introduced daily thereafter through the summer by holding a half-pint of the earth in a bowl-stainer under each inlet. The finer particles are washed through the strainer and carried by the current to all parts of the trough. The sand thus introduced keeps the bottom free from slime and is allowed to accumulate. When the sacs are absorbed the fry are siphoned out. Those to be liberated are carried in pails to the lake, and in the same pails or in cans, the water being frequently changed, they are conveyed by boat or canoe to suitable places along the shore, care being exercised to scatter them widely.

The troughs are now thoroughly cleaned, partition and headscreen removed, and 1,000 young fish are returned to each trough to be fed through the summer. The flow is increased to about 10 gallons per minute, and later to 15 gallons as the temperature rises.

Four feeds per day are offered, consisting of herring roe and beef liver ground together in a meat-chopper, the method being to mix the ground food with water to the consistency

of cream and throw a little into each trough, scattering it well and going at once to the next trough. When the entire series has been treated, the operation is repeated, food being offered three times at each feeding period in amounts varied according to judgment.

Dead fish and waste are removed with fan or scoop each day, care being used not to touch the fish when it can be avoided, and the sides of the trough are cleansed about every fourth day. The sand on the bottom is disturbed only as much as is necessary for removal of waste. When the troughs are cleaned the dams at the foot are lifted so that the slime and waste are drawn by the extra strong current thus created to the lower end of the trough and taken out. In brushing the foot screen, even outside, care is taken that no fish be lying against it, lest fins or tails be injured.

After feeding is begun and until the fish are large enough to cause alarm lest they jump out, the cover is left off the upper half of the trough through the day. This gives free access for feeding and offers the fish a choice of coming into the light or remaining in comparative darkness under the lower cover. They seem to enjoy the light and will lie there unless disturbed.

Now as to results. Of 2,000,000 eggs taken, 72 per cent eyed, and of these 98 per cent hatched. The fry lost 2 per cent and at this writing the fed fish are losing about 1 per cent in ten days. The above suggests the questions:

I. What is that essential condition met by fish spawning naturally, and by fish culturists when practically all eggs are fertilized, but which is missed when less than all are fertilized?

All who have handled eggs and fallen short of perfection in fertilization will hope with the writer that an answer to this question may be forthcoming. If we cannot now answer it, the question seems worthy of further study, since it is not apparent why there should be any failure of fertilization in the case of ripe eggs rightly handled.

II. What quantity of light should be admitted to eggs, fry,

and fed fish? The writer believes for eggs and fry the less the better, and that older fish should at least have a refuge from sunlight.

III. May fry or older fish be handled or even touched without danger? The writer suggests that the conditions which will admit of handling are exceptional, and that it is to be avoided as far as practicable. A fortunate instance of this exceptional condition is that of salmon at spawning time, when the skin is so toughened that the fish may be handled without injury. It may be mentioned in passing that this is not true of the togue (*Cristivomer namaycush*).

IV. Where and how shall fish be planted?

On this point the suggestion is offered that where no local objection exists a stream is the proper place, but that there and elsewhere, scattering is all too liable to be regarded as one of the minor details.

THE KING SALMON OF ALASKA

By John N. Cobb,
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The king salmon (*Oncorhynchus tschawytscha*) of Alaska, known as the chinook and quinnat elsewhere on the Pacific Coast, is one of the most interesting and valuable of the salmons found in Alaska.

It has been conclusively demonstrated that king salmon frequent the waters of Southeast Alaska throughout the year. This section contains an immense number of large and small islands, which are separated from each other and from the narrow strip of mainland separating Alaska from Canada, by large sounds, straits and bays of salt and brackish water, in which the fish find ample food. During the spring months large schools of herring frequent the shoal waters for the purpose of depositing their spawn, and it is then that the king salmon are found in the greatest abundance, as they are pursuing and devouring the herring. They also consume large numbers of the smelt and eulachon during the annual runs of these fishes to the rivers to spawn. Octopi and other miscellaneous animal food are also found in the stomachs of the salmon at times.

During the winter the kings are but rarely seen at the surface. Some are, however, taken every winter on halibut trawls set at times in 30 and 40 fathoms of water in Ernest and Frederick sounds and Chatham Strait, and these salmon usually have halibut, rock cod and cod in their stomachs. At this season but little animal life is found near the surface, hence the kings are compelled to go deep for their food. Indian fishermen on the Stikine River say that kings are found in the deep pools along the river during this season, and they get them by cutting holes in the ice and spearing

the fish. Kings are also said to be found in the river at the Hot Springs, about 40 miles from the mouth, where they remain until the ice melts in the rest of the river.

In the spawning season the king salmon ascend certain streams during the months of May, June and part of July. They are also found running as late as August and September in the headwaters of the Yukon and its tributaries, over 2,000 miles from its mouth. The principal streams frequented at this season are the Unuk, Stikine, Taku, Chilkat and Alsek rivers in Southeast Alaska; the Copper and Kenai rivers in Central Alaska, and the Ugashik, Ugaguk, Naknek, Kvichak, Nushagak, Togiak, Kuskokwim and Yukon rivers in Western Alaska. It is possible that they also enter certain of the streams debouching into the Arctic, but this has not yet been definitely established. A few are found along the Arctic Coast, however. It is the general belief in Alaska that this species enters only those streams which carry glacial waters.

Some of the Southeast Alaska fishermen claim that king salmon spawn at different periods of the year, and that they do not all die after once spawning. In proof of these beliefs they instance the numerous small kings found with well-developed spawn and the many large kings with immature spawn.

At Ideal Cove, just off the mouth of the Stikine river, in May, 1908, the fish cleaners found a 7-pound male king with milt. Several days before a female king of about the same size with fairly well developed roe had been handled, also a 20-pound king with roe of about one-fourth the size of that in other fish taken at the same time. A reliable Juneau fish dealer, who has been handling salmon for years, states that he has met with a number of cases of small and immature roe in large kings, also of large roe in kings weighing from 10 to 15 pounds. I myself have taken from a king salmon weighing about 25 pounds a single slender strip of roe, about 6 inches in length, which was composed of quite small and immature eggs. This was at a time when the great part of the run was of fish with well developed roe.

This variation in size of roe and fish might be accounted for if there were two runs of kings during the year, as in the Sacramento and Columbia rivers, but, so far as our knowledge extends, such is not the case in Alaska. In July of this year (1909), a period when the schools of spawning fish have reached those portions of the rivers above tidewater, king salmon were taken by means of trolling in various parts of Southeast Alaska, thus showing that all do not spawn the same year, even though they may be uniform in size.

While the fish are feeding they are caught solely by trolling, being so scattered that the use of nets is unprofitable. In trolling the white fishermen generally use either the Hendryx Seattle trout bait spoon No. 5 or the Hendryx Puget Sound No. 8. The former comes in nickle or brass and nickle and brass; the full nickle is preferred. The Siwash Hook No. 9/0, known as the Victoria hook in British Columbia, is in quite general use. As a rule but one hook is used, and this hangs from a ring just above the spoon, while the point of the hook comes a little below the bottom of the spoon. Occasionally double or treble hooks are used. Some fishermen use bait, and when this is done the herring, the bait almost universally employed, is so hooked through the body as, when placed in the water, to stretch out almost straight and face forward as in life. Generally the line is trolled near the surface, but sometimes a heavy sinker is attached and the line sunk some 30 to 50 feet below the surface.

When hooked the king makes a most gallant fight for life, sometimes a half hour being required to land one with an ordinary trolling line hauled in hand over fist. When a rod and reel is employed several hours are sometimes required to land a large specimen. The fishermen claim to be able to distinguish by its actions whether they have a red-meated or a white-meated fish on their hook. If a red-meated fish it will break water once and then sound, while a white-meated specimen will make its fight for life close to and at the surface, and will also fight much harder than its darker colored brother.

When the kings begin to school, preparatory to ascending the rivers to spawn, they are taken almost wholly by means of gill nets. They will rarely ever take a bait at this time.

The most peculiar characteristic of the Alaska king salmon, and a most unfortunate one for the fishermen and dealers, is that the flesh is not always of uniform color. In Southeast Alaska the flesh of the majority of the fish taken is red, but in about one-third it is white. Occasionally a specimen is taken with the flesh on one side of the body white and on the other red, the line of demarcation being very distinct. A few also are found with the white and red intermixed, giving a mottled appearance. In Cook Inlet, in Central Alaska, the run is composed wholly of red-meated fish, and in Bristol Bay, Bering Sea, the earliest runs are almost wholly red-meated, but white-meated fish appear in the later runs.

The fact that the majority of the fish are red-meated in Alaska shows that this is the natural color of the flesh of the king. This is further attested by the fact that southward all along the Pacific Coast the runs of this species are wholly, or in majority, red-fleshed fish. The Sacramento and Columbia river kings are virtually all red-meated, the white color becoming prominent first in Puget Sound waters.

As the commercial value of the king salmon is largely dependent upon the degree of redness in the color of its flesh, it is easily to be seen that an excessive proportion of white-meated fish in the catch would seriously affect the price. In disposing of his catch in Alaska the fisherman insists that the dealer shall take the white-meated kings along with the others, which is done at a considerably lower price—about one-third that paid for red-meated fish. The greater part of these are shipped fresh and disposed of for what they will bring in the Puget Sound markets.

It has been noticed that the largest and fattest fish are usually white-meated. One taken in May of this year, in the neighborhood of Klawak, on the west coast of Prince of Wales Island, weighed, without the head, 101 pounds, which

is the largest king salmon reported from Alaska. Some people in Alaska claim that the white-meated fish when cooked have a better flavor than those of a red color. The exterior appearance is exactly the same, the only way to determine whether the fish has red or white flesh being by cutting it.

The reason for this remarkable variation in color of flesh is still unknown. It has been ascribed to the food of the fish, but this would hardly seem to be borne out by the few facts so far gathered in Southeast Alaska, where the variation is most noticeable. I have personally opened a number of stomachs of king salmon, and have also watched the cutters at the fishing establishments doing the same, and found the same class of food in them without regard to the color of the flesh.

Herring is the principal food of both varieties and it does not seem reasonable that this food could have such opposite effects in two fishes traveling practically side by side. The color could not be caused by food at present unknown to us. unless this food was partaken of during the winter months, when, owing to the lack of animal life at the surface, due to the coldness of the climate, the fish seek the deeper waters and are only occasionaly taken on trawls set for halibut.

Several housewives have stated to me that in a few instances when cooking red-meated kings they observed the flesh to turn white during the operation. Experiments in the cooking of this species might possibly disclose the reason for the variation in color.

DISCUSSION.

DR. BARTON W. EVERMANN: I think attention should be called to two or three conclusions which the writer seems to have reached.

In the first place the question of white or red meat is not one that is limited to Alaska. White-meated salmon and red-meated salmon are found all along the coast, at least as far south as the Columbia River; but the percentage of white-meated salmon in Alaska is usually regarded as much greater than in the Columbia River. The theory of the Indians that they can tell whether the fish is red-meated or white-meated by the way it bites or pulls or whether it sounds, is an interesting one. The red-meated one jumps, I believe, and then sounds; the white-meated one does not jump at all. It frequently happens that a fish is half and half—about half is white-meated and about half is red-meated—now what would one of this kind do when hooked? And of course there are white-meated ones in the Yukon and Bristol Bay, as well as farther down the coast.

It has often been stated by various persons that they cannot believe that salmon die after spawning but once, because they are not all of the same size. That doubt or that conclusion would be based upon the fallacious belief that all salmon of the same age must necessarily be of the same size, and upon the additional fallacious belief that all salmon necessarily spawn at the same age. Mr. Cobb's theory apparently is that a fish which is very large has spawned more than once, and the smaller one perhaps only once. You might just as well reach the conclusion that a man who weighed 300 pounds has been married three times and a man who weighed 100 pounds had been married only once or not at all. (Laughter.) There is no more reason in the one case than in the other. There is no reason why all king salmon that are three years old should tip the beam at exactly the same notch. It is quite certain that they do not. In fact everything that is said regarding the nature of salmon of different sizes has been known along the Columbia River, and to everybody else almost, for many years.

THE RAINBOW TROUT IN MICHIGAN

By Seymour Bower,
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The few points I desire to present in regard to rainbow trout cannot be considered as rising to the dignity of a formal paper, but are offered for what they are worth and mainly with a view to calling out discussion as to the relative value and comparative merits of one of the gamest of American fishes. In speaking of rainbow trout I wish to explain that I also include steelhead trout, which for practical purposes may be considered one and the same species. Indeed, so high an authority as Dr. David Starr Jordan told me within the past thirty days that he now considers the rainbow and steelhead as one species, although he was formerly in doubt and at one time regarded them as separate.

The introduction of rainbow trout into Michigan streams dates back to the early eighties, in fact, a small planting of rainbows was made in the Ausable River in the middle seventies by the late N. W. Clark, of Clarkston, and the late Daniel Fitzhugh, of Bay City. Prior to that time the rainbow was a total stranger to Michigan waters and was entirely unknown throughout the east and middle west. For nearly twenty years after the first planting by the Michigan Fish Commission, the distribution was exceedingly limited in numbers and was confined to a few streams. The total number planted by the Michigan Fish Commission from 1880 to 1889, inclusive, was only 67,000 fry. During the next decade the total of the plants was 437,000, or an average of less than 50,000 per year. Beginning with the year 1900, however, the distribution of rainbows by the Michigan Board was made on a somewhat more generous scale. From 1900 to 1908, inclusive, a total of about 5,500,000 fry and

nearly 100,000 fingerlings were deposited, or an average of over 600,000 per year. During the present year our total output will approximate two million fry and a quarter of a million fingerlings. From present indications our output of 1910 will total between three and four million. Thus it will be seen that the Board of Fish Commissioners of Michigan believe that the planting of rainbows is a valuable contribution to the fishery resources of the State.

Since the planting of these fish in Michigan was taken up by our State Board, distributions to some of the same waters have also been made by the United States Fish Commission and Bureau of Fisheries, but in much smaller numbers. It if safe to say that less than 10,000,000 rainbow trout all told have been distributed throughout Michigan during the thirty years in which the work has been carried on, or an average of less than 350,000 per year. Nearly ten times as many brook trout have been planted in Michigan during the same period by the State Board alone, yet in proportion to the number distributed the production of adult rainbows is much greater than of brook trout. Indeed the planting of rainbows in this State has been attended with more generous results and perhaps has proved more successful in every way than any fish cultural work attempted by our Board. Rainbows weighing five pounds and upwards now inhabit many of our streams by the hundreds. In the St. Mary's, Pere Marquette, Pentwater, Boardman, Pine, Muskegon, and other rivers, 8, 10 and 12 pounders are not uncommon and specimens ranging from 14 to 16 pounds have been taken. Twenty pounders have also been reported as having been caught with nets, but it is difficult to verify these reports because net fishing for rainbows is illegal. There is, however, scarcely a doubt that rainbows of that size now inhabit some of the above waters. The Ausable River, which with its numerous spring-fed tributaries constitutes one of the greatest brook trout systems in this country, if not in the world, is also one of the best rainbow trout streams in Michigan in the middle and lower reaches of the main river.

Here as elsewhere the larger rainbows, or those of a spawning size, do not as a rule run into or invade brook trout territory proper, except during the spawning season, after which they drop down stream to their old haunts where food and temperature conditions are more congenial. In some cases large rainbows prefer to inhabit deep and moderately cool lakes, ascending tributary streams only during the spawning season.

There is scarcely a doubt that the rainbow in the course of time will rank as a commercial fish of considerable importance in Lakes Michigan, Superior and Huron, and in these waters they should not be regarded or treated as a game fish but rather as a commercial fish, subject only to the same restrictions as are applied to the other commercial varieties. Large rainbow trout lose their game qualities to a great extent anyway after inhabiting lakes for a time.

Regarding the food qualities of rainbows as compared with brook trout, it must be acknowledged that they are usually softer and less palatable than the latter when young or immature, that is to say, the flesh of a 7 or 8-inch rainbow is not so firm and sweet and rich as that of a brook trout of the same size. One reason is that an 8-inch rainbow is not nearly so far advanced toward maturity as an 8-inch brook trout. Rainbow trout do not spawn in Michigan waters until they are 3 and most of them until they are 4 years old, whereas brook trout spawn when about 20 to 22 months old. It is, however, the almost unanimous opinion of anglers and epicures that rainbows of two pounds and upwards are not in the least inferior to brook trout of a corresponding size or age. For this reason, the legal limit for rainbow trout should be considerably greater than for brook trout. It should not be less than 10 inches.

Although the rainbow trout has very many firm and even enthusiastic friends, and the list is constantly growing, yet there has been and still is considerable opposition to its further introduction into our streams. This opposition is not because it is not recognized as a high grade food and

game fish but because it is considered inferior to brook trout and is driving the latter out. A careful investigation of the situation, however, will, I believe, show to a very great extent that this claim has little or no foundation in fact. It is true that a number of our larger streams, once suitable for brook trout from sources to mouth, are now occupied by rainbow trout in the middle and lower waters, almost to the exclusion of brook trout. The natural supposition is that the latter have been driven out, when as a matter of fact such waters would now be deserted by the brook trout if the rainbows had never been introduced. The clearing up of heavily timbered areas or sections has so changed the character and temperature of many streams that the brook trout have retreated nearer and nearer the headwaters. I do not for one moment favor the planting of rainbow trout into any stream or stream system that is suitable for brook trout from sources to mouth, though the introduction of rainbows into such waters will not displace the brook trout to anything like the extent that is generally supposed. The truth is that while the young rainbows may mingle with the brook trout until they are one or two years old, they are certain sooner or later to drop down stream, seeking warmer and more congenial waters. Another good reason why rainbow fry should not be planted in cold brook trout waters is that they are to a great extent preyed upon and destroyed by the brook trout. The hatching season of the rainbow occurs in May and June, and if the young fish are turned out as fry they are just about the right size to serve as food for young brook trout whose hatching season is about six months earlier, as well as for the yearlings. Brook trout are more carnivorous, more destructive of their own kind and of fish life generally than are rainbows. In proportion to their size they have a much larger mouth, more teeth, are more ravenous and feed more during the months of May and June than at any time of the year. Although rainbows will spawn to some extent on the same grounds as brook trout, I believe that the fry should be planted farther downstream. But wherever planted, the separation of these

two species will take care of itself in a great measure, because each is at its best under a different set of conditions, and will seek those conditions.

The game qualities of rainbows are so well understood by anglers generally that little need be said on this point. Of course I do not refer to the old and superannuated fellows who are passing the evening of their life in the quiet waters of lakes, but to the lusty and vigorous young stock of the pools and riffles and rapid waters of our larger rivers. Doubtless many of the members of this society have read the following from Jordan and Evermann's "American Food and Game Fishes." If any of those present have read it, I am sure you will be pleased to hear it again, and if any of you have not, you have missed something good:

> In beauty of color, gracefulness of form and movement, sprightliness when in the water, reckless dash with which it springs from the water to meet the descending fly ere it strikes the surface, and the mad and repeated leaps from the water when hooked, the rainbow trout must ever hold a very high rank. The gamest fish we have ever seen was a 16-inch rainbow trout taken on a fly in a small spring branch tributary of Williamson River in Southern Oregon. It was in a broad and deep pool of exceedingly clear water. As the angler from behind a clump of bushes made the cast, the trout bounded from the water and met the fly in the air a foot or more above the surface; missing it he dropped upon the water only to turn about and strike viciously a second time at the fly as it touched the surface; though he again missed the fly, the hook caught him in the lower jaw from the outside, and then began a fight which would delight the heart of any angler. His first effort was to reach the bottom of the pool, then, doubling upon the line, he made three jumps from the water in quick succession, clearing the surface in each instance from one to four feet, and every time doing his utmost to free himself from the hook by shaking his head as vigorously as a dog shakes a rat. Then he would dash wildly about in the large pool, now trying the opposite direction, and often striving to hide under one or the other of the banks. It was easy to handle the fish when the dash was made up or down stream or for the opposite side, but when he turned about and made a rush for the protection of the overhanging bank upon which the angler stood, it was not easy to keep the line taut. Movements such as these were frequently repeated and two more leaps were made. But finally he was worn out after as honest a fight as trout ever made.
>
> The rainbow takes the fly so readily that there is no reason for resorting to grasshoppers, salmon-eggs, or other bait. It is a fish whose gameness will satisfy the most exacting of expert anglers and whose readiness to take any proper lure will please the most impatient of inexperienced amateurs.

DISCUSSION.

DR. BARTON W. EVERMANN: The rainbow still stands as the banner game fish of those that I have ever caught. The Society may be interested in hearing a word in regard to an investigation that the Bureau is carrying on now with reference to the relationship of the rainbow, steelhead and cut-throat trouts of the Pacific Coast. Dr. Gilbert of Stanford University began more than a year ago to study this question seriously, and is still continuing it. Among other things he examined the stock of fish at all of the trout hatcheries in California, Washington and Oregon. He collected from various undefiled streams (so as to get if possible native fish) fish that had not been contaminated through fish cultural operations. He then took and fertilized eggs from what were regarded as undoubted rainbows; then the eggs of undoubted steelheads were likewise taken and fertilized. He is keeping the progeny separate and under observation until they reach a size that will enable him to know whether any differences develop. The experiments are being carried on chiefly at the Brookdale hatchery near Santa Cruz, California. The California Fish Commission is heartily co-operating with the Bureau of Fisheries in this work. Dr. Gilbert feels that when he gets through with the investigation he will know positively the taxonomic relationships of the steelhead and rainbow for the regions in which he experiments. He has already gone far enough to justify him in saying that the conclusions which will be reached from a study of the rainbow and the steelhead of the Santa Cruz region, south of San Francisco, will not necessarily hold with regard to the rainbow or steelhead in Washington or Oregon, so that there are several local problems each of which must be solved on the ground.

It is regretted, I think by all of us, that the stocks of rainbows and steelheads and hybrid rainbows and steelheads in the hatcheries on the west coast are not safe for experimental purposes. You cannot be sure of the genealogy or ancestry of any of them; so wild stock has to be obtained in every case. But even considering the great care taken, in many cases doubts will arise. However, I think Dr. Gilbert is eliminating all individuals where there is any doubt as to the true stock; he is experimenting only with what he believes to be undoubted rainbows on the one hand and undoubted steelheads on the other. He has written a number of letters to the Bureau from time to time detailing his experiments and expressing in a tentative way some of his conclusions, but closing in every case by saying that all these conclusions are merely tentative.

PRESIDENT: I know I ought to keep my seat, but I cannot help breaking in. I have studied the rainbow trout to some extent and am very much interested in them. I suggest that before Dr. Gilbert finishes his studies he will necessarily have to go to Alaska and study the rainbow and steelhead there, because if I know anything about fish, I am sure that they do not represent the same species. Some years ago Dr. Jordan,

after having declared that the rainbow and steelhead trout were identical, found what is now recognized as a steelhead and he set it up as a distinct species. Dr. Evermann I think even now is inclined to believe that this particular species must be set off from the common rainbow as well as from the steelhead.

I am too much engaged in trying to produce and distribute fish to have time to follow the details of the technical study of fishes, but we get eggs from a race of rainbows that cannot be distinguished by external marks from the original rainbow brought from the McCloud River in California. We take eggs as early as December and at some of our stations as late as April, or pretty close to the first of May.

Now, are there several races of the *irideus?* I suppose so—some early spawners and others spawning later. We certainly have them, and I think you will find by looking over the records of the early work of the New York Commission that the difference was noted as early as 1868 or 1869, long before eastern fish culturists had meddled with the relationships of the western fauna. It is an interesting point. I think I can tell the difference between a young rainbow and a young steelhead every time. I may be wrong, but I think the steelhead is always slimmer, that he has more white margin on his anal fin, and perhaps a white caudal tip which I do not find on the rainbow.

I am very glad that Dr. Gilbert is going into this subject with the wild fish, for the question will never be settled until a conclusion is reached on virgin ground. As it stands now we certainly have two races of rainbow trout, and neither one of them is the same as the steelhead, at least not what I call the steelhead.

MR. JOHN W. TITCOMB: Mr. Bower's paper has opened my eyes somewhat about the rainbows in Michigan. When I was engaged in fish culture in Vermont I supposed from what I had read that the introduction of the steelhead and rainbow into the waters which by deforestation had become warmer in the summer, would be a good plan. But there we encountered the obstacle which usually comes with the warmer water of summer, namely, the extremely cold water of winter. I discovered the rainbow was sensitive to anchor ice, which not only would cause large mortality in hatching but also among the adult fish when little needles of ice were flowing through the water. The rainbows which have been introduced in New England and New York in large numbers for a good many years do not seem to have produced very favorable results. There are today but few streams which have been successfully stocked, and in few of those which have been stocked do the adult fish hold their own by natural reproduction.

Now, as to the identity of the steelhead and rainbow, I think you all understand that the rainbow of New Zealand is the steelhead of California. It has been thoroughly identified from the source of supply, and is what might be called a sea-run rainbow. I could not see the difference between the steelhead hatched in Vermont and the rainbow hatched in Vermont. If they got mixed I was unable to sort them, although I always imagined the steelhead was a little more gamy than the rainbow.

I remember calling on Commissioner Brice in Washington once, and saying to him that I could not see any difference between the two fish; that I thought they must be very closely related; and he said: "Well, I have given out word that the rainbow and steelhead are two distinct species, and that settles it!" (Laughter.)

Now, as to the spawning time to which you have referred: I find so far as my observations go, and what I learn from the different superintendents, that it is regulated very largely by water temperature. As you know, at Wytheville, Virginia, we have handled rainbows for a great many years, and the first hatch from the domesticated stock there was in the spring. As time went on the spawning season gradually turned backward until now we take eggs in November from descendants of the same stock of rainbows. In Vermont rainbows hatched and reared in very cold water where anchor ice flowed part of the time, did not spawn, as I remember it, until April or May. In Colorado where the rainbow is an introduced species it spawns just before the native trout in the same waters; in others at about the same time; but on the average in April and May, perhaps a month earlier than the native trout.

PRESIDENT: By native trout you mean the black-spotted?

MR. TITCOMB: Yes. We are taking black-spotted trout eggs now. I do not see how we can connect the spawning time with the species, for it will be found that fish of the same stock will spawn in one water even three months earlier than in another.

PRESIDENT: In Lake Cayuga last fall we took rainbow eggs in December, and again in the same lake as late as April. We also took a steelhead in Keuka Lake last fall. If it was not a steelhead I do not know what it was, for certainly it was not a rainbow.

MR. TITCOMB: My observations agree with those of Mr. Bower, that rainbow trout seek the lower waters. In Vermont they take the waters usually below those where brook trout are found, except an occasional straggler or a very large fish that goes farther down into the deeper pools. This water is rather warm for brook trout. In Colorado the native black-spotted trout occupies the head waters, the eastern brook trout the middle course, while rainbows are principally found in the lower and larger portions of a stream. There the rainbow is the most popular of the three species, I think, the eastern brook trout ranks second and the native third.

You may be interested in knowing that the Denver & Rio Grande passenger agent has a standing offer to any angler who lands with fly and rod and reel a rainbow trout weighing ten pounds or more. His reward is a $20 gold piece for each fish, which he usually has to pay about twice a year. The largest rainbows are generally taken from the Gunnison River.

MR. W. E. MEEHAN: The matter raises a query as to what we have at Bellefonte. Some four or five years ago we received from the United States Bureau of Fisheries station at Wytheville, Virginia, what was stated to be a consignment of rainbow trout. They were fingerlings and as they grew up, apparently two species developed. They were so dif-

ferent that any person standing on the edge of a pond could distinguish them. In one case the fish were much darker on the head and back, with a square tail—just as square as the brook trout—and in the other case the fish were much lighter, and with a decidedly forked tail, with other marks such as you have mentioned as belonging to the steelhead. The former were supposed to be steelheads and the latter rainbows. Both fish spawn at the same time, from the latter part of November to about the first of January, the water temperature being about 54 degrees F. in the ponds.

As regards the spawning period of the rainbow trout, I have this experience to relate. Early in the 70's there was received from the United States Commission a shipment of rainbow trout eggs, presumably from the west. They were hatched and appeared to be all alike. They were divided into two lots, one being sent to the Allentown station and the other to the Corry station. The water at the Allentown station was 52 degrees F. and at Corry 48 degrees F. The Corry fish when they reached maturity spawned in April, towards May. The fish from the same lot of eggs spawned at Allentown about the first of November.

MR. TITCOMB: What is your experience with the rainbow in Pennsylvania waters? We have sent carloads of rainbow trout there, in response to the great demand for them, and then all of a sudden the anglers said they did not want rainbows.

MR. MEEHAN: I have made inquiries everywhere but I cannot find a single stream in Pennsylvania where the rainbow or steelhead seems to thrive naturally, or at least to any great extent. There were one or two places where it appeared as though they were spawning naturally in a stream, but investigation showed that people who were getting rainbow trout for certain other streams, instead of carrying them to those streams, were planting them in the stream in which we were finding evidently three-year-old rainbows, two-year-old rainbows, yearling rainbows and fingerlings. I do not know of a stream in Pennsylvania where rainbows seem to be spawning naturally.

At the Allentown station we also found a very large percentage of unfertile fish every year. Today at the Bellefonte station at least 50 per cent. of the males and females are barren. At the Corry hatchery the percentage of fertile males and females is better, but even there many of the fish are unfertile. There has been such a large percentage of unfertile rainbows at the Wayne station that their propagation has been discontinued at that place.

Going back to the fish at the Bellefonte station, the square-tailed fish that we have supposed to be steelheads, though much the same as the other fish which I presumed to be rainbows, the question is, what are they if not steelheads?

I have a mounted specimen of a fish caught in an Erie County stream, said to be a steelhead trout, that weighs ten pounds. The fish had a square tail and other alleged marks of a steelhead. There was also another specimen of the same species taken from Lake Giles in Pike County, but it was destroyed by fire last year.

MR. FRANK N. CLARK: Some of the members seem to consider it quite remarkable that rainbows should spawn in December and also in April. Why is it any more so with rainbow trout than with brook trout? There is even wider range in the case of the latter, for they spawn from September to February. We have a record at Northville of taking brook trout eggs from the same pond in October and February. Then what is there remarkable about the spawning season of the rainbow? We do not know but that it may be the same in their native waters. I do not think anyone will raise the question but what it might occur there; and certainly in transferring them here to new waters, we should not consider it unusual when the same thing occurs with our native brook trout. It is a matter of record that at Northville years ago I personally took brook trout eggs in February. I saw eggs taken from the same pond again in October.

MR. MEEHAN: That is all right, but I do not think it is a parallel case. It is true that at some of our hatcheries brook trout begin spawning the last week in September, as at Corry, and generally they have finished by the first of December. The spawning is continuous but if we transfer the fish to another station it occurs the first or second week in October, according to the temperature of the water. If we transfer rainbows from one station to another the spawning season is either mainly in the fall or spring.

MR. SEYMOUR BOWER: In regard to the rainbow and steelhead being one species, I would say that recently I had the honor of dining with Dr. Jordan in Detroit, when he stated that he had now made up his mind that they were one and the same species. He said that he had seen perfect young rainbows hatched from what were said to be steelhead trout, and perfect young steelheads from what were claimed to be rainbow trout. Now, while he did not state that these results were what made him think they were one and the same species, I inferred that this had a great deal of weight with him. He illustrated his position by a little incident. Those of you who have met Dr. Jordan know that he always has a fund of dry humor on tap for every occasion. A few years ago he had a friendly argument or controversy with a certain gentleman and said to him: "What is your authority?" "Why," was the reply, "Appleton's Encyclopedia, and I consider that very good authority." "Well," said the doctor, "I wrote that article myself, and I have changed my mind since." (Laughter.)

PRESIDENT: The rainbow trout in New York is, I think, coming more into favor than formerly. The demand for them is greater now than it was five years ago. We find that it does best in lakes from which it can enter tributary streams suitable for spawning purposes. For instance, Keuka Lake is a great rainbow lake at present, and from there they run up to Pleasant Valley stream which flows through our hatchery grounds. We take them in large numbers at the mouth of the stream, usually in March or April, and sometimes we take good eggs in December, apparently from the same kind of fish.

There are a great many lakes in New York which are suitable for

rainbow trout, and they cannot get away except to run up the tributary streams for spawning, which they do. We are told also that rainbows stay in some streams from which they could escape, but instead they remain and multiply and furnish good fishing. For example, rainbow trout were introduced in Great River, Long Island, by the Southside Sportsmen's Club about as early as they were anywhere in the State of New York. The club tired of them and concluded to let them go to sea. They went, but kept coming back to the river during spawning season, even trying to spawn in the waters of the club, and now the members would not part with the rainbows for anything, for they have as fine rainbow trout fishing as could be desired.

MR. TITCOMB: Why should you choose rainbows in a certain lake in preference to the native trout? Is there something about the lake which makes it better fitted for the rainbow than for the native trout?

PRESIDENT: Keuka Lake is a great body of water for lake trout. It is not suitable for brook trout so far as I know.

MR. TITCOMB: You would not introduce rainbows in a lake where brook trout thrive?

PRESIDENT: I don't know. It has been done very successfully in some waters, in Adirondack lakes, for instance. Mr. Woodruff also has them in his private lake and he is very fond of them. He continues to introduce them along with the brook trout, raising them both in his hatchery.

DR. EVERMANN: It seems to me that there is some danger in reaching or drawing any positive conclusions from an observation on domestic rainbows and steelheads. I presume it is true that the domesticated rainbows in the various fish hatcheries of the country, or that have been planted in various streams in the east, have come from several sources; some are the descendants of fish that first came from the San Francisco region, the home of the original rainbow, while others are from up the Sacramento. The latter may have been either the Shasta or the Stonei species or sub-species. So it is quite probable that the domesticated rainbows of the country have come from at least three different sources, and are the descendants of at least three different species or sub-species. Now, the same is probably true of the steelheads. Steelhead eggs have been brought from the Columbia River and from Baker Lake in Washington, and perhaps other places. Whether or not it is the same steelhead throughout all of the west coast is still a question.

I quite agree with Dr. Bean that if you should look at the rainbows of Alaska and the steelheads of Alaska and had your eyes half open, you would be loath to admit that they were one and the same species; so that it goes back to the statement made a few moments ago regarding the line along which Dr. Gilbert is working. He does not propose to base his conclusion, or his only conclusion, upon an examination and comparison of the rainbows and steelheads of California in the Santa Cruz region, but will consider those of the Sacramento and farther up the coast. I think he is in the Puget Sound region now, and will eventually go to Alaska, which is one of the best fields for his work because there the strains are still pure. Fish culture has not come in and upset things

as it almost always does. It mixes things inextricably, so that in many regions problems of geographic distribution will remain forever unsolved. For illustration, consider the Panama Canal. If a careful biological survey of the waters of the two coasts and of the fresh waters of the isthmus is not made before the canal is completed and water runs through, many important problems which ought to be solved will forever remain unsolved.

MR. TITCOMB: It is true that we get our rainbows from two or three sources in California, and our steelheads from California, Oregon, Washington and the Puget Sound region. Of course they have become more or less mixed. Some have gone to Colorado waters, where eggs have since been taken and shipped east. The stock at the Wytheville station was obtained from different sources, but a part of it came from Colorado.

While we are on the subject of acclimatized species, I want to announce that anglers are having great sport at Sunapee Lake, New Hampshire, with the chinook salmon which has been introduced there from the Pacific coast along with the silver salmon. This year I received a letter from Mr. W. M. Kiel, of the Tuxedo hatchery in New York, saying that many chinook salmon weighing from four to five pounds and up to eight pounds are being caught. It is rather difficult to get hold of specimens because people catch and eat them without letting us know about it until afterwards. We are anxious to learn whether this Pacific coast fish will adapt itself to our New England lakes and breed there. Certainly it is furnishing great sport, and the New Hampshire Fish Commission is very enthusiastic over it.

PRESIDENT: What species did you say?

MR. TITCOMB: Both the silver and the chinook salmon, but only the chinook has so far been taken and officially identified. I think the silver salmon may also be found, as we planted more silvers than chinooks.

PRESIDENT: Do you recall the experiments of the Trocadero Aquarium in Paris?

MR. TITCOMB: Yes. Chinook salmon actually breed there.

PRESIDENT: I saw them.

MR. TITCOMB: Yes; and I saw their progeny.

MR. MEEHAN: Mr. Titcomb's reference to the silver and chinook salmon reminds me of our experiment with silver salmon. Two years ago we received 100,000 eggs from the Bureau of Fisheries and sent them to the Wayne hatchery. I retained 10,000 fry and endeavored to rear them. The rest have been planted in certain streams in Wayne County tributary to the Lackawaxen and Delaware Rivers. Several small specimens of silver salmon were caught by fly fishing before the close of the season. The fish were four or five inches long and were brought to the hatchery for identification. Meanwhile the 10,000 that we retained grew rapidly, took food and remained perfectly healthy. They are now about a year and a half old and will run from six to nine inches in length. They rise very freely to the flies that skim the water and take food eagerly and show every sign of being a fish that will thrive in confinement in fresh

water. We may have to put fences around the pond to keep them from leaping out. They will jump two or three feet if anything is thrown to them, taking food as eagerly as brook trout. It looks as though the silver salmon is a fish that will thrive in our lakes. We feel very much encouraged in this work.

PRESIDENT: Going back to the origin of the rainbow trout in New York, I know from the records that the first eggs received at Caledonia came from J. B. Campbell, who was in the Shasta region. He was at one time an assistant of Mr. Livingston Stone on the McCloud River. That was the source of the first eggs hatched in New York; and others came from the same region a little later. Since that time New York has received rainbows from the United States Bureau of Fisheries. But the original stock of fish, it appeared to me, showed at least two subspecies. Mr. Frank N. Clark was on the McCloud River in my company in 1876, I think it was. At that time the rainbow trout were very plentiful in the river, and it seemed to me at least—I don't know whether Mr. Clark will remember it or not—that there were two kinds of rainbows in the McCloud River, the common stubby rainbow and a slimmer fish. I presume one was a subspecies and the other was a true *irideus*.

MR. FRANK N. CLARK: It is true that in 1876 Dr. Bean and I made a trip to the Sacramento River with shad, then went on up to the McCloud River. In 1877 I went to the coast, Mr. Quinn accompanying me. In 1878 I made the same trip with shad again, and in going to San Francisco I arranged with the proprietor of a private hatchery for a supply of yearling rainbow trout, which we brought back to Northville. The first rainbow eggs ever taken in Michigan were from those fish, but they were not the first rainbow trout planted in Michigan. Previous to 1876 we had eggs; just where we got them I don't remember; but they produced the fry that Mr. Bower mentioned as being the first rainbows planted in the Au Sable River. The next lot of fry came from the yearlings that we brought across from the coast in 1878. We started with 125 yearlings from four to twelve inches long and reached Northville with some of the larger fish. We had a small take of eggs from those fish and the fry were planted in the Au Sable River by Mr. Fitzhugh.

PROPAGATION OF CRAPPIE AND CATFISH

By John L. Leary,
SUPERINTENDENT U. S. FISHERIES STATION,
SAN MARCOS, TEXAS.

It is not so much for what I know about the propagation of these fishes that I take up this subject, as it is to find out through the discussions of the Fisheries Society what others know. It seems as if everybody connected with fish culture in the United States has kept quiet about the propagation of these two valuable species. At the thirty-fifth annual meeting of this Society I asked some questions as to handling crappie—from my standpoint important questions. But they elicited only a blank, no one seeming prepared or caring to answer. I will now give you some of my experience during the past eleven years at the San Marcos, Texas, station.

During the fall of 1897, I collected 40 very fine crappie (*Pomoxis annularis*) from the Colorado River near Austin, and from Yorks Creek, about 18 miles south of San Marcos, and placed them in one of our best ponds. The waters of the Colorado and Yorks Creek are always slightly roily and often very muddy. After transferring these fish to San Marcos station, which was done with an unusual amount of care (as this fish I find hard to handle at all seasons in this climate) and after leaving them in the pond at the station for several days, I found every few days fish suffering from pop-eye, the eye enlarging until it seemed ready to burst from the head; then fungus set in and the fish died in a few hours.

This continued until I had lost nearly all my 40 fish. I had never handled crappie before, except to catch them in the creeks of eastern North Carolina, but these creeks were always roily and muddy after heavy rains. So I came to the

conclusion that the very clear water of San Marcos station was not suited to the fish. It must be that this clearness affected the eye. So I planted the remainder of the fish in my carp pond, which the carp kept muddy at all times. This proved the remedy, the fish beginning to improve and thrive at once, and when the pond was drawn in the winter I found 8 splendid specimens of crappie.

This led me during the next season to the following experiment. I wired off the narrow part of one of my ponds with one-inch galvanized chicken fencing, the inlet to this pond leading direct into the part wired off, and in this portion of the pond I placed 8 large carp, each weighing from 6 to 8 pounds. The effect was that the carp kept the pond at all times slightly muddy and the crappie placed in this pond had no pop-eye and produced quite a crop of young. I also noted that there were no young carp, showing that the crappie, both young and old, had fed on the young carp.

The results of this experiment led me to obtain from some of the nearby ranch owners the privilege of stocking their cattle tanks with crappie, allowing me to have a part of the young fish. These tanks are always slightly muddy and the result from these ponds or tanks, while not very large, has enabled San Marcos station to plant several thousand young crappie each year.

I also find it worse than useless to handle young crappie in this climate until the cool weather of winter sets in and hardens them. They will not stand handling and icing like other fish during the summer, the slightest change in temperature or water affecting them and producing that desperate disease fungus, to which this fish, more than any other I have ever handled, is liable. For roily or muddy ponds the crappie, or white perch, as it is known in Texas, is the very best fish, thriving as no other fish will, and it is of the very best of our fresh-water kinds.

Now for the catfish. I have tried to propagate both the spotted catfish (*Ictalurus punctatus*) and the blue channel catfish (*Ictalurus furcatus*) for the past four years and have

met with no success in the ponds at San Marcos station. We find both of these fish in the San Marcos and Blanco rivers, usually in the swift water over gravel or sand shoals, and I have an idea that they spawn in these rapid places, though it is said they seek holes in the banks of streams. So far, however, I have not located such spawning places; in fact I have not found their spawning grounds. Both fish are valuable for their food qualities. I have heard advanced a very foolish idea that eels must be kept in ponds with catfish if it is desired to have the latter spawn. This, however, is too absurd to carry any weight. I mention it merely to show the foolish notions of some fishermen.

I will be pleased to have through discussion all the information now in the hands of the Society as to the successful propagation of the above mentioned fish.

DISCUSSION.

MR. JOHN W. TITCOMB: We have tried to propagate the channel cat and the Mississippi cat at half a dozen different pond stations without success, and from the observations we have made I think nobody definitely knows where they spawn. It is the general impression that the *Ictalurus punctatus* spawns on the little riffles around the rocks in perfectly clear, swift water. They are gamy and will not stand domestication in small ponds. We have a great many applications for these fish from people who want to stock small ponds. But it is useless to put them into ponds of small area, as they require ample range and do best, I think, in swift water.

MR. W. E. MEEHAN: Several years ago we tried to propagate spotted catfish but with no success whatever. We tried them both in pond and stream without results in either case. With other species which we know as the white and yellow catfish, we have met with great success. To what extent this work is successful elsewhere, of course I do not know.

Any ordinary pond 100 feet square or larger will breed the fish; but we find that in order to succeed we must have heavy, hard clay banks, so that the fish when ready to spawn may dig a hole in the bank that will not cave in. The water should also be cloudy. When the little fish have arrived at the advanced fry stage, they leave the nest or hole, guarded by the large fish, and begin as we call it "rolling." The large fish circle round and round and move the fry over the pond in the form of a ball-like mass. When these balls begin to break up, the fry are gathered in by means of a net and put into a vacant pond, where they are fed and held for shipment as fingerlings. We find that the adults

do not require a great flow of water; but in order to keep them healthy they must be liberally fed, not only through the summer, fall and spring, but during the winter. The manner of feeding in the winter is to cut a hole through the ice and sink to within a foot of the bottom a wire basket filled with cut liver. The catfish feed therefrom very readily and emerge in the spring fine and plump and in good condition for spawning. I suppose we now have at our hatcheries from 700,000 to 800,000 young catfish ready for shipment.

In the propagation of calico bass we had better success where the water was a little cloudy. We experienced no particular difficulty, but the nests were built so deep that there was little opportunity to examine their character or the spawning habits of the fish. Some nests were found in eight feet of water and often only the appearance of the young fish around the shores led to the discovery of a nest.

MR. WARD T. BOWER: In regard to Mr. Meehan's remarks, it seems advisable to call attention to the fact that he has been discussing the yellow catfish—*Ameiurus nebulosus*—which is quite different from the species referred to in Mr. Leary's paper.

MR. MEEHAN: Entirely different.

MR. BOWER: So that the failure Mr. Leary has met with perhaps cannot be explained by Mr. Meehan's remarks.

MR. MEEHAN: We absolutely failed with the spotted catfish, just as Mr. Leary did. In fact we gave it up three or four years ago, because we were unable to do anything with them.

MR. W. J. O'BRIEN, Gretna, Nebraska: What do you call an ordinary sized fish pond.

MR. MEEHAN: One of our successful ponds is about 150 feet square, another is 200x50 feet. I call them rather small ponds, but five or six of them furnish us about 700,000 or 800,000 fish.

PRESIDENT: I think some of you will recall the fact that many years ago the calico bass was introduced into France, and that an account of the spawning habits and nest building of the fish was published in a French fish cultural journal, "Pisciculture," I believe. The article appears in one of the bulletins or reports of the United States Fish Commission and corresponds very closely with the description given by Mr. Meehan as to the nest building and depth of water in which they spawned, also the comparative ease with which the young fish may be produced.

MR. CHARLES W. BURNHAM: At the Tupelo, Mississippi, station we propagate crappie and bream in one pond about an acre and a half in size. They spawn in comparatively shallow water, about two feet deep. When this pond was drawn last fall we collected from it 9,600 crappie and over 10,000 bream. It is supplied principally with artesian well water and contains a heavy growth of pond plants. It also receives muddy surface drainage water in the spring, which seems to bear out the statement of the other gentlemen that crappie breed best where the water is somewhat roily. I also think that they require an abundance of vegetation.

MR. S. F. FULLERTON: The best evidence that crappie spawn in muddy water is found in the Mississippi River. For several years the government has collected bass and crappie at Winona and La Crosse, on the Mississippi. In the spring and up to June, after the crappie have spawned, the river is high and muddy. When it overflows the parent fish go into the sloughs to spawn, and as the water recedes we follow up and collect the small crappie and bass. In this way we saved 300,000 fingerlings last year, mostly between Winona and St. Paul, and the government collected, I understand, a much larger number. Besides stocking lakes in the state, we are also saving and putting the rough fish back into the Mississippi. They are taken in large numbers with the crappie. As the latter cannot be moved any distance in warm weather, they are not sorted out but are turned into the river with the rough fish. The bass can be shipped, but crappie will not stand shipment in a water temperature over 70 degrees F. We have tried various schemes but without success. Roily water is the place to hatch crappie; it cannot be done in clear water.

MR. TITCOMB: We treat calico bass and crappie almost indiscriminately in our distribution work. They seem to require the same conditions, that is, roily water during the spawning season. Mr. Catte, however, has a series of ponds fed by bottom springs of clear water, where he successfully propagates strawberry bass.

MR. EUGENE CATTE, Langdon, Kansas: I hatch thousands of them in clear water.

MR. CLARK: Do you mean crappie or strawberry bass?

MR. CATTE: Strawberry bass.

MR. TITCOMB: Mr. Meehan says strawberry bass do best in cloudy water.

MR. MEEHAN: That is true. Our strawberry bass did decidedly better where the water was a little roily.

MR. O'BRIEN: Our experience has been quite different. We raise strawberry bass and crappie under exactly the same conditions. I believe roily water is essential for the crappie. Moss is not necessary, however, as we find thousands of crappie in natural streams like the Platte, Elkhorn and Missouri rivers, where there are practically no water plants.

MR. WARD T. BOWER: While I can give no authority for the statement, and perhaps it is a popular misconception, I have heard that a turbid condition of the water is necessary for crappie because of a peculiar construction of the eyes. Perhaps some one here has heard something along this line, and can throw further light on the subject. Possibly Dr. Evermann can tell us something about it.

DR. EVERMANN: I know nothing about it.

PRESIDENT: Both crappie and calico bass have been introduced very extensively in the eastern part of New York, and have so multiplied that we are beginning to draw from stocked lakes for brood fish. For instance, when the New York Aquarium wanted to stock the park lakes of New York City and Brooklyn last spring, they asked the

Forest, Fish and Game Commission to furnish some crappie or calico bass—the names are used indiscriminately. What we have is really the deep-bodied fish, the true strawberry or calico bass. It is very abundant, especially in Kinderhook Lake, which is in Columbia County, and also in Nassau Lake, in Rennselaer County. One of our protectors went to Kinderhook Lake and easily seined about one thousand calicoes varying from a few inches to six inches in length. Then came the difficulty of getting them to New York. The water was warm and of course a great many were lost in transportation.

Another place where both calico bass and crappie are raised very successfully is in the vicinity of Covington, Kentucky, where Joe Schlosser, during the time of the Cincinnati exposition, had some artificial ponds from which he took ice in winter. These ponds were stocked with crappie, calico bass, pike perch, carp and bass, fishing privileges for which afforded a good source of revenue. The strawberry bass is evidently suitable for pond culture under almost any reasonable conditions. Kinderhook Lake is not muddy, but of course there are places where the fish can get the mud if they want it.

MR. MEEHAN: It has deep water?

PRESIDENT: Yes.

MR. MEEHAN: That answers the same purpose. Do you use ice in shipping them?

PRESIDENT: I have tried all methods, but cannot carry them in warm weather.

SOME ESSENTIALS IN POND CULTURE

By Felix A. Lauman,
PALESTINE, TEXAS.

Success in pond culture depends upon having a well defined system of procedure, together with surroundings approaching natural conditions as closely as possible. A station site should consist of from 20 to 30 acres of ground, so located as to allow the construction of ponds with sufficient fall to permit drawing off and also to dispose of all waste water. In addition there should be a flow which will fill the ponds and keep a constant current through their entire length. This prime factor is often overlooked. Too often hatcheries have to resort to pumping plants and other devices in order to keep the ponds filled, since the supply is only standing water without any current or overflow, the ponds thus really becoming tanks. Tank culture would be a more appropriate name for this kind of fish culture. An abundance of pure fresh water is as essential to the life and growth of the fish as pure fresh air is to the life and growth of man or plant.

There should be an investigation into the history of the lands, particularly as to past overflows. No greater calamity can befall a hatchery than an overflow, with the loss of brood stock and young fish, destruction or damage to ponds, buildings, and other property, thus ruining the prospect of success for years.

There should be a careful study of the chemical composition of soil and water. There is danger here not only of poisonous substances, but of others not conducive to success. With a hard clay soil and pure fresh spring water nearly all aquatic plants flourish, and these plants facilitate the production and growth of insects, so essential as food for the fish.

Having proper natural conditions the next requirement is suitable ponds, either natural or artificial, and of these there should be three distinct kinds of different sizes—spawning ponds, nursery ponds, and storage or shipping pools. As to the construction of the spawning ponds, in my observation the larger and deeper ponds yield the best results. A pond should be not less than one acre in extent, should have an oval or bowl shape, with a large area of shoal water, and an inlet at one end and an outlet at the other, in order to produce a current through the entire pond. The sloping bottom should gradually increase to a depth of from six to nine feet at the kettle and outlet. Nests, preferably of small gravel, should be placed over the bottoms of the ponds about 6 feet from the bank and about 20 feet apart, the nests being from 18 to 20 inches in diameter. These ponds should be well supplied with aquatic plants, which not only afford the fish a hiding place from their enemies but are essential to the presence of the animal life which constitutes the food of the young fish.

On account of the cannibalism among the young fish of some of the species, the larger ones mercilessly devouring the smaller and weaker, it becomes necessary to construct smaller ponds called nursery ponds into which the young fish are assorted as to size when taken from the spawning pond. In the building of these ponds great care should be taken to afford the young fish protection from their enemies and to have them well supplied with suitable vegetation, crustacea, small insects and other natural food. A pond 50 feet long by 25 feet wide, with a depth of 3 feet at the outlet, would be of good working size.

The storage or shipping pools are used for holding young fish when taken from the nursery ponds for shipment. They are small pools with concrete bottoms, a six inch brick wall for the sides, with a thick cement coating over bottom and sides, and are 6 feet wide by 12 feet long, the bottom gradually sloping to a depth of three feet at the outlet.

THE FUTURE OF THE CARP

By S. P. Bartlett,
U. S. Fisheries Station, Quincy, Ill.

From the experience of the past let us consider what are the possibilities of the future in regard to the culture of the carp. Few, if any, economic experiments looking to increasing the food supply of the people have shown such satisfactory results as has the introduction of the carp into the waters of the State of Illinois by the Bureau of Fisheries.

It is not necessary to recall the prejudice existing against carp in the early years of its introduction, how they were thrown away by the fishermen when taken in their nets and how they were pronounced worthless by nearly all who undertook their culture. The press throughout the country denounced them, and those responsible for their introduction. All this and more is familiar to most of you who have met with this Society year after year, and joined in the discussions brought out by papers which dealt with the subject. All of it was simply the result of a lack of knowledge of the value of the carp and ignorance of the possibilities connected with its culture.

It has taken a long time to demonstrate this value, but many States that were loud in their denunciation are now willing to accept the commercial advantages the carp represents, and openly advocate its culture, protection and care as an important addition to the supply of food fishes.

Everywhere, as generally as any of our indigenous fishes, we may find the carp, and it is not unusual to hear fishermen before legislative committees make the assertion that if they can be given a free rein to take carp they will gladly assist in the enforcement of any law for the protection of the game fishes. Without a knowledge of what the catch

of carp is doing for the commercial fishermen it would be impossible to form any idea of its real value from a commercial standard. Statistics will, I think, show nearly or quite 22,000,000 pounds of carp taken from the Illinois river and the lowlands adjacent to it during the season of 1908, and the majority of these fish were taken from the flat lakes, ponds and bays tributary to the Illinois river.

One might ask what progress has been made in the increase of the fish indigenous to our Illinois waters in the last twenty years that can not be traced indirectly to the carp. We have more bass and the reason is because we have more food for them by reason of the vast reproductivity of the carp.

In predicating the possibilities of the future of the carp, several phases must be considered. What has been the greatest food producer, and incidentally the money maker of the waters? Not the bass, nor the buffalo, once the great coarse fish supply of the Illinois river valley, but the carp. And why? First, because of its adaptability to all the waters of the State, with their varied conditions. Then because of its wonderful reproductive powers; its tenacity of life, which gives it a commercial value not possessed by any other fish; and finally, its real value as a table fish when properly taken and properly prepared.

We find carp everywhere and everywhere prospering. Other fish are killed out by adverse seasons but the same conditions do not fatally affect the carp. Every energy and all the ingenuity of man are exercised to take these fish, and if laws are lax all is to the detriment of the carp, yet they are continually on the increase. When sent to the markets they are always shipped "round," that is, not dressed, and I am told that they arrive at distant markets, if not alive, at least in such firm and perfect condition, when properly packed, as to meet the requirements of those great consumers of fish who insist that the blood must show when they are cut.

So much for the present status of the carp as a commercial asset of the people of the Illinois and Mississippi Valleys.

Now what of the future? The age of improvement, I believe, will affect the carp as it does all else and changes will occur that will greatly diminish the output. The Illinois river, for 250 miles on either side, presents an almost unbroken chain of lakes, usually flat, and many of them of great area, that are ideal homes for the carp, but increasingly each year, these bottom lands are being formed into drainage districts, and immense areas now producing hundreds of thousands of pounds of carp and other fish are being drained and the land cultivated. Such lakes inside of the levees as are not affected by drainage will be controlled by private corporations or individuals. The result will be that the river will have to furnish all the fish for the commercial fishermen. This condition is true of all bottom lands along both rivers, and it will be a live question soon as to where the fish are to come from.

So far, there has been but little effort made to cultivate carp for market and where such efforts have been made the results for various reasons now matter of history were failures. I believe the time is now ripe to utilize the hundreds of acres of water to be found throughout the State in the cultivation of this fish. With the knowledge we have of the life habits of the carp, and the care and feeding and protection necessary to its culture, the best results can be obtained. Systematic effort united with the same amount of care that would be used in any other enterprise would result in success, without doubt. Carp, like everything else, respond to care and attention, and if given as intelligent care as would be used in raising chickens may be expected to give the best of results. In this way better fish would be produced and better prices obtained.

The great trouble is and has been that carp have been taken from water at a high temperature, when the flesh would nat urally be soft and unfit for table use if a good flavor be expected; but careful investigation has showed that carp can be so handled that all the muddy or oily flavor can be removed.

Proper attention and feeding would add greatly to the

texture and flavor of the flesh, as well as to the rapidity of growth. I know of no other fish that responds so quickly to good food as does the carp, yet it is easily and cheaply cared for.

I have in mind a large number of places where carp culture could be undertaken with profitable results and if the supply is kept up to the demand, the time is not far distant when such places, now practically a waste, can be utilized so that the water can be made more productive than the land.

I can make no better argument as to the future possibilities of carp culture than to ask you to consider the following quotation from one of the best authorities on the question of fish food supply, Dr. Hugh M. Smith, Deputy U. S. Commissioner of Fisheries. He says:—

> It will suffice to say (1) that special investigation has shown the carp does exceedingly little harm to any other fish, as anyone would expect from its known habits and anatomical peculiarities; (2) that the injury done to the feeding grounds of wild fowl has been grossly exaggerated; on one hand, a scarcity of ducks may occur entirely independently of the presence of carp, and, on the other, a great abundance of carp may be coexistent with an undiminished growth of wild celery; and (3) that the carp is a food fish of very great importance, and to say anything to the contrary is to ignore facts.

The carp is here to stay. The markets take all they can get and ask for more. Thousands of acres of water can be utilized for successful culture, but in order to bring this about, intelligent application should be made of best known methods and care.

PROGRESS IN HATCHING STRIPED BASS

By S. G. Worth,
U. S. Bureau of Fisheries, Mammoth Spring, Arkansas.

Twenty-five years ago (Bulletin of the U. S. Fish Commission for 1884, p. 229) official view was expressed that the experts in fish culture would easily care for and develop with slight loss the eggs of the striped bass (*Roccus lineatus*), and that the real difficulty had been not so much in the hatching as in the finding of a place where the mature fish could be obtained with any certainty. Experience has demonstrated, however, that apologies have followed all attempts to hatch the eggs of striped bass, because of the disappointingly small product in fry. As I have, at last, overcome the difficulties in hatching this species so that any given lot of eggs may be hatched with entire satisfaction, I herewith present the facts which mark the progress in hatching to date, May, 1909.

Eggs of striped bass are easily hatched, as in pans of water, on wet trays, and in jars, but the rupturing of the yolk sacs subsequent to hatching has been a constant cause of heavy loss, the story of which is told in the floating pads or rafts of amber colored oil on the surface of tanks containing the fry. The sacs are almost as easily ruptured as the walls of a soap bubble.

The McDonald jar, as equipped with its discharge tube of glass and rubber, and the fry required to pass into the fry-tank through this, gives almost negative results with striped bass because the volume of water for these eggs—but one quart a minute—is insufficient to keep the rubber discharge tube filled. Hence the fry turn sommersaults in the passage down the incline to the tank, and are too badly shaken up to survive even though the sacs are not actually ruptured.

Finding pitcher-mouth or lipped jars also unsuitable for hatching, I bored in the McDonald jar, near the top and just below the shoulder, a smooth, round hole, and inserted a six-inch length of 7/16-inch rubber jar-tubing, tight fitting, a little more than flush with the inner surface of the jar, and when the fry emerged they passed into the fry tank through this tube rather than through the ordinary glass and rubber tubing from the top of the jar. This connecting tube was in horizontal position, the outer end inserted into the side of the fry tank by means of a ⅝-inch bit hole, a water tight joint being effected by the union of tubing and wood. Before hatching commenced the end of the tubing at the tank was closed with a bottle stopper of cork, whereby the jar was kept full and overflowing at the customary discharge point at the top, that being an open hole in consequence of the discarding of the rubber and glass tube heretofore employed as the exit for dead eggs and fry. When the eggs were ready to hatch the cork stopper was withdrawn, affecting the discharge of the jar through the horizontal rubber tube, water no longer passing out at the top of the jar, and the level of water in the jar dropping from the top down to the level of the horizontal rubber exit. The head of water was so regulated in the fry tank that the horizontal communicating tube was at all times submerged, whereby it was impossible for the fry to receive any shock or injury of any kind. The hatching result was all that could be desired.

It was long ago found that metal screens were totally inadmissible in tanks for striped bass fry, and recourse is had to fabric screens, cheese cloth or batiste made into carefully sewed bags which are drawn over the strainer or siphon cages and firmly tied. But these, until this year, were a part of the siphon employed to carry away the water from the fry tank. I have since discarded the siphon feature, as it was quite impossible, in large work, to employ this without destroying fry. The substitute consists of the same cage and bag and the same kind of ¾-inch stiff rubber hose, but differently arranged. A piece of the hose about a foot long is

thrust in a bit-hole in the side of the fry tank, making a water-tight joint, about an inch of the hose projecting on the outside and the longer part on the inside of the tank. To the inner or longer end the cage and bag are attached in the regular manner, this being accomplished by lifting the end of hose above the water surface of tank. More than one discharge is provided for a tank to allow for renewal of strainer bags while the tank contains fry. The rigidity of the hose holds the strainer away from the sides and bottom of the tank, where fry sacs would otherwise be crushed. As the outer end is fixed and an open orifice, the head of water in the tank is inevitably fixed at a given point, and is necessarily constant.

Thus, it will be noted that in the jar the customary discharge tubing is discarded, and in the fry tank the siphon feature and siphon cup are eliminated—a simplification in apparatus and the attainment of ideal results.

The tank head at the beginning of the season was 4 feet and 4 inches, afterward, almost unavoidably, increased to 5 feet and 2 inches. Another season I would reduce the tank head to 3 feet or less, for the avoidance of free air in the rubber and glass tubing connecting the jar with the water-piping, the free air being a phenomenon that is encountered every season when the greatest number of eggs are in the hatchery. Spawning, occurring at 69 to 70 degrees, takes place on a marked rise in temperature that is usually continuous for some days, and is attended with the free liberation of air from the water to a bothersome extent, slowly and almost imperceptibly charging the feed tubing of the jars with free air to the extent of reducing the flow of water and causing the eggs to become matted if neglected long. But it is not the matting of the eggs that gives greatest anxiety, rather is it the difficulty in actually keeping the flow of water up to the standard and yet not wash the eggs out of the jar. When there is air in the rubber tube and the petcock is correctively opened far enough to restore the inadequate flow in a jar, the attendant may have gone but a few feet away when it is dis-

covered that the eggs are overflowing from that jar into the sewer. The additional water he had turned on soon pushed the accumulated air out of the tube, and too much water was now being delivered. The petcock was already opened far enough, the obstruction being the air in the rubber tube, which he did not and could not see. It can be seen only when it accumulates sufficiently to reach down into the glass tube. The rubber and glass tubing devised for the McDonald jar contemplated the use of two quarts of water per minute and are too large in bore for the one-quart flow in striped bass hatching. By lowering the tank head I anticipate the using of more water, and, while avoiding the blowing out of the eggs from the jar, establish such an increase in volume and movement of water in the tubing as to minify the accumulations of air.

Before concluding this paper I wish to present an innovation in the removal of dead eggs from jars in the striped bass operations at Weldon, N. C., which may be more widely applicable. It has the advantages of speed, positive identification of good or bad eggs in transit, and simplification of apparatus. I discard the conventional discharge tubing of the jar, both glass and rubber, allowing the water to escape at the open hole at the top of the jar. When ready to remove dead eggs I take a short glass tube and place upon it one of the small rubber washers designed for the jar stuffing-boxes, placing the washer perhaps near the middle of the tube. Inserting an end in the jar at the waste-hole, it is hardly seated when the water overflows at its top. If the tube is not inserted far enough in the jar to induce the exit of dead eggs I press upon its upper end, when it slides smoothly downward through the washer until it has reached the proper depth and the outward passage of dead eggs may be observed. To make sure that these are dead eggs, note the single layer that gradually spreads over the metal plate which covers the top of the jar, the eggs having slipped down the outer surface of the glass tube to that point, where the outside ones are in turn pushed off by the succeeding ones.

There is just enough water around the eggs on the plate to afford a thorough inspection, although they are moving, the opaque discoloration being discerned with definiteness. But this is not all. By moving the tube and its washer up and down, by a gentle shaking motion, the outward passage of water and eggs is arrested at will, and an altogether satisfactory examination is entirely practicable. One person can look after a half-dozen of these tubes at one time and be free from anxiety as to the loss of good eggs, and if he is needed elsewhere he slips all tubes out and walks away, knowing that not another egg will pass until he reinserts the tubes. I accord the credit of this new and fascinating method to Mr. Wm. W. Spears, who has for a number of years been temporarily employed at Weldon. I had expected to use a siphon, of rubber and glass tubing united, but one of which, however, could have been operated at a time by one person.

If the foregoing methods of transferring fry from jar to fry tank and of removing dead eggs from jars can be applied to shad work, we shall witness the discarding of all jar exit tubes, both glass and rubber, at one stroke. The adoption of these methods would, of course, imply the using of the modified jar here described for striped bass hatching, viz, the jar with the fry escape through its side and through the 7/16-inch jar tubing. I think that these methods are certainly applicable to shad operations, but their adoption in that branch does not imply the discarding of the metal screens in fry tanks. Jars properly fitted for such work should, of course, be moulded with the side opening in them, for the drilling of the glass invites breakage.

At Weldon last spring 22 fish were stripped, producing 11,336,000 eggs, an average of 530,000, the weight of fish averaging 16 pounds and ranging from 5 to 50 pounds each. Eleven ripe fish were unstripped by inadvertence of fishermen. Each of the 22 lots of eggs produced more or less fry. All eggs were taken, fertilized, and delivered by the fishermen unaided, and paid for at the rate of $20 per million.

PROTECTING THE UNDERSIZED TROUT

By G. H. Thomson,
ESTES PARK FISH HATCHERY, ESTES PARK, COLORADO.

I desire to thank the Society at this time for the assistance given me at the Congress which convened last September in Washington by the indorsment of the recommendations I offered for the protection of the undersized trout.

I desire also to state a few of the facts which led me to take up the cause of the small fish, and which from my own personal investigation convinced me beyond a reasonable doubt as to the effect of grasping an undersized trout (which the law requires shall be returned to the stream) with a dry hand, when removing from the hook.

One year ago, I desired to have a couple of large trout to place in one of my hatching troughs, in order to compare them with the records; and also to show the beauty of the trout in their natural state. I caught, with a dip net, two yearling eastern brook trout from the stream that runs in front of the hatchery, and removed them from the net to a bucket of water by grasping them with a dry hand. Immediately my hand was covered with the slime from the backs of the fish. Several days after placing the fish in the hatchery, I noticed that a white fungus growth had begun to form upon their backs where I had grasped them with my hand. I watched them closely from day to day, and found that the fungus was increasing. I had observed fish in this condition before but did not have them where I could follow them.

When I have any trouble with my fish in the hatchery I always use salt in the water, as salt is a disinfectant. So I then prepared a strong solution of salt water in a pan and placed the fish in it, one at a time; one of them was overcome by the salt in three minutes, and I removed it to spring water, where it revived in ten minutes; the other one I held for five minutes in the salt solution, and it recovered in fifteen minutes time.

I watched the fish very closely from day to day, and found that I had checked the fungus, but I also found that I had destroyed the sight of the first one, so I killed it; the other one began to loose all of its outer coating and coloration, but after a few days it began to eat and the beauty to return, "like a bird molting." I kept it in my hatchery all of last summer, and showed it, an object lesson, the result of grasping with a dry hand. I have since caught this fish with my hand wet, hundreds of times without injury. I have the same trout in my hatchery at the present to exhibit its beauty.

From this experiment I was led to the printing of the cards, "A plea for the fish," for the education of the fisherman, but have found that some of our old and experienced fish men require enlightenment of this same kind. One denounces the proposition as "bosh," stating that he has had twenty years experience in the fish business, and has never found that condition to exist; but his statement simply goes to prove and support the position that I have taken, for he was speaking from the standpoint of a fish man, and when he handles spawning fish, he takes them from a tub of water, with hands always wet; but the fisherman takes the fish from the hook with his hands dry.

I never show the beauty of a trout here in the hatchery, without pointing out the effects and danger of the dry hand. I called upon the advertising agents of all of the railroads that run trains into our mountains during the fishing season, and urged upon them to insert in their advertising matter for this season the information as to how to handle a fish taken from a hook. They did so; and the work last summer in this direction is having its results this season, for the information given is being applied by the fishermen, and they are educating others. It is all a matter of education.

NOTES ON THE LEAPING OF THE PACIFIC SALMON

By Henry B. Ward,
UNIVERSITY OF ILLINOIS, URBANA, ILL.

Both story and song are replete with praises of the leaping powers of the salmon. The energy, grace and precision with which it is able to surmount the rocky barriers in its native streams are exploited by naturalist as well as fisherman until I think it fair to say that the general public regard it as exemplifying the most perfect natural development of the leaping power. All of these descriptions are written no doubt with reference to the Atlantic species, *Salmo salar,* which has a wide range along both coasts of the Atlantic Ocean, and since the time of the Romans at least has been the favorite of angler and epicure alike. Its peculiar right and title to the popular name has caused Professor Goode to write of it: "*Salmo salar,* the only true salmon in the whole group of nearly one hundred species of the Salmonidæ, has always stood preeminent, like a Scottish chieftain, needing no other name than that of his clan."

It has never been my good fortune to be able to observe the Atlantic salmon in its native haunts and I have no accurate data by which to measure precisely the accounts of its powers which appear in prose and poetry. Two years ago, however, I was privileged to spend some time under the auspices of the United States Bureau of Fisheries in the study of the Pacific salmon in Alaska and at that time made certain observations on the leaping power of the species (*Oncorhynchus nerka*) commonly known as the Alaska or red salmon. I am indebted to the Hon. Geo. M. Bowers for this opportunity and for permission to make use of the

data recorded here. While my observations are very incomplete and constitute only a fragmentary preliminary communication, yet they are positive in certain respects and afford an intersting comparison with the better known and more aristocratic Atlantic salmon.

As I am now on my way to Alaska to complete studies begun on that previous trip, it may be possible later to add more data to those already noted down on the jumping powers of this salmon. Meantime I should be indebted to any of the members who may be able to point me to published evidence concerning other definite observations on this or related species.

The observations recorded here were made about the middle of the run of salmon on Naha stream, near Loring, Alaska. About half way from salt water to Heckman Lake, in which these salmon regularly lie to ripen for spawning and on which the Alaska Packers Association has a large hatchery, one finds the only fall in the course of the stream which is more than a rapids. This is known as Dorr Falls and forms a straight drop about three or four feet high with only one break, near the left bank. Here a spur of rock leads out obliquely away from the crest of the fall in such a way as to give an unbroken flow of water about a foot lower than the general level above the fall. The salmon go up from salt water in bunches or schools, usually starting at the time of a heavy rain, which, owing to the character of the drainage basin, raises the level of the stream very promptly and markedly. When such a school has reached the deep pool at the base of the fall they apparently rest a short time and the following day may be found actively engaged in the effort to surmount the falls. While we watched the pool, the jumping seemed continuous, as if not merely a single fish but several at least were in the air at once, and it was only rarely that one could note any intermission between the jumps. Yet the camera gave evidence of the deception practiced on the eye. Of some thirty snaps taken at random when the jumping seemed most frequent, only six caught fish

in the air and only one of these showed two fish jumping. One optical illusion was thus effectively dispelled.

I was interested to see whether the fish chose any particular point of attack for the leap. As already indicated the fall was considerably lower at one place and the jump necessary to reach solid water above was consequently much shorter. Yet so far as I could tell within the time of my observations, fewer fish tried the fall at that point than at others either right or left of it. I was inclined to believe that the point of attack was determined largely by the depth of the water below the fall. At least the shallowest points were those from which the fish did not jump, and the extreme left of the stream where the water was quietest and certainly very deep was also one of the most frequented jumping places. It was also the place where the fall was most perpendicular and highest. At the same time it must be recorded that some fish were seen jumping all along the entire line of the fall and that the preferred point of attack seemed to shift from one half hour to the next.

It was difficult to determine the height of the jump made by the salmon. There was hardly a single case in which a fish jumped higher than the crest of the fall and in nine out of ten cases at least the jump was not high enough to reach the crest. The fish dashed frequently right through the sheet of falling water and struck head first against the face of the rock with sufficient force to stun them so that they were carried away disabled, floating down stream some distance before they recovered sufficiently to start in swimming again. Even when trying at the low point of the fall they often landed on a rock, bounding off against another point only to be carried down by the rush of water.

The length of the jump was very variable, as also the starting point of the leap. At times a salmon rose from the water near the face of the fall and again one came from the smoother waters some distance back from this point. In the latter case even a long fine jump resulted only in bringing the fish down head first among the rocks at the base of the fall.

I was fortunate enough in one photograph to catch such a salmon just as he dropped head first into the mass of foam and rocks.

One of the most striking features of the salmon leaping was a distinct lack of directness. Many of the jumps were made at an oblique angle which rendered the effort ineffective. Some were directed towards the bank, some parallel to the line of the fall. In a few cases I even saw a salmon shoot out of the pool, make a splendid jump directly away from the face of the fall and land far out in the open water. The type of jump was exactly like that used in making the fall and entirely unlike that observed in open water when the salmon are entering estuaries or passing through fresh water lakes, so that one is forced to conclude that the leaping salmon is at times diverted from the proper direction by unexpected swirls or currents in the water or is unable to judge correctly the direction for a correct leap as well as the height and length necessary for effective work, or finally makes some leaps aimlessly without due regard to the end to be attained. All things considered, the jumping of the Alaska salmon at these falls made upon me the impression that there was a clear lack of definiteness as well as accuracy in the efforts made for the attainment of its purpose.

It may be well to say here a word concerning the leaping of the salmon in open waters away from falls or other obstacles in its path. I have observed the pink salmon jumping on various occasions in the salt water of Behm Canal, of the estuary near Loring and in two lakes of the Naha stream. The fish jump sidewise from the water; the body is bent slightly so as to be concave toward the direction from which the fish comes; the vertical height reached is relatively small and the fish merely falls back nearly flat on the surface of the water with a splash which recalls the "belly-whopper" of our boyhood days at the old swimming hole. In this case, however, the fish lands flat on the water, side down. There is no leap from the water and subsequent dive head first into it as in the case of the true jump at the falls. I have tried thus far

in vain to photograph a fish in this posture in the air, and have succeeded only in catching the splash. A photograph of the head of the inlet loking into Roosevelt Lagoon, where a school of salmon were waiting for the proper tide to enter the lagoon and start the ascent of Naha stream, shows at the right a splash which by its form and extent indicates that the fish has landed flat on its side with the head towards the left of the observer. The pink salmon always make this characteristic splash when jumping in open water and the jump itself in extent, direction, termination and posture of the fish is in positive contrast with the leap made at the falls. It is not at all like the jump of a salmonid seeking a fly and I have never seen a similar leap in any other species. Apparently its aimlessness suggests sport or moderate excitement due to mild and ill-defined stimuli. It cannot be confused with leaping at the falls and cannot be easily related to the latter or derived from it.

Finally a few notes were made on the posture of the fish when attempting to surmount the falls. As the salmon emerges from the water the body is rigid and during the very brief interval of the aerial flight manifests no movements that can be detected. The dorsal surface is usually slightly concave, although in one case the reverse was apparently true. I think the former is characteristic of the successful leaps and perhaps of all at the start while the latter is seen near the end of a jump and so far as I could observe is infrequent at best. As the salmon sails on through the air one can easily see that the lateral fins are expanded and set at an angle towards the side which makes of them wings or organs for soaring and they remain in this position even in unsuccessful attempts until the fish reaches the water.

The powerful strokes of the caudal fin made when a salmon reaches the solid water at the crest of the fall have often been observed and commented upon as the means by which the fall is finally surmounted and the quiet water beyond is attained. I observed this action often in case of the red sal-

mon but can add no items of importance to the records of other observers.

I have been influenced to bring this imperfect study before the Society in order chiefly that I might benefit by the observations and suggestions of a group so skilled in the study of fish under natural conditions.

THE INVASION OF THE POTOMAC

By Henry Talbott,
WASHINGTON, D. C.

To those who have known the Potomac well it has always been one of the greatest of fishing streams. Strange to say, the fishes for which it was once famous have now nearly disappeared, and it is fished now for an alien stock, for most of its biting population has been imported.

The following interesting extract from Captain John Smith's narrative is evidence of the early date at which the river was asserting its eminence:

> They afterwards went up the river as high as they could with their boats and were received in some places kindly, and in others in a hostile manner. Up a small river then called Quiyough, which I take to be Potowmack Creek, was a mine like Antimony. In this the Indians dug, and washing away the Dross in a clear Brook, which ran by, they put the Remainder in little Bags, and sold it all over the country, to deck their Bodies, Faces, and Idols, which made them look like Blackamores dusted over with Silver. Newport had carried some of these Bags home, and assured them that they were found upon trial to contain half silver. Being therefore very eager after this mine they obtained Guides from Japazaws, King of Potowmack, who lived at the mouth of that little River and went up to it; but all they got, proved of no value. Towards the Falls of Potowmack, they met several parties of Indians in Canoes, loaded with the Flesh of Bears, Deer, and other wild Beasts, which they generously imparted to them; and in divers Places, they saw that abundance of Fish, lying with their Heads above water, that their Barge driving among them, for want of a net they attempted to catch them with a frying-Pan, But they found that a bad instrument to catch Fish.

It is interesting to note that the antimony mine with whose glitter the dusky dandies silvered their bronze bodies was not on Quiyough, which is the present Acquia Creek, but on Quantico, 10 miles above, then called Ochquayo River, and navigable for their light draft sea vessels to Dumfries, five miles above. And the mine a couple of miles beyond is not

antimony, but a low grade pyrites—still commercially worked, now 1400 feet in depth—which furnished the chests of "fool's gold" which the school histories tell us some of the early explorers hopefully carried back with them to England.

Another colonist from Jamestown came still higher up the river, and spent a season among the friendly Indians on the Eastern Branch opposite Washington where he saw taken at night, off the site of the present steel works on Giesboro Point, a great catch of sturgeon. And Captain Smith, of some unlocated point says: "There was once taken 52 sturgeons at a draught and at another 68." However, net fishermen resented the sturgeon's destructiveness when caught in their gill nets and seines, and waged war on young and old; carrying a ready billet always to dispatch them. Sturgeon fishing was up to thirty years ago quite an industry at points down the river; a few are yet picked up in drift nets in the Potomac, and their capture is of considerable importance in Chesapeake Bay, but they have practically disappeared from the river where they were once so plenty.

John Colegate, before the fifties, one of the oldest writers on fly-fishing on this river, tells of catching shad with the fly at Long Bridge, and incidentally that the shad averaged then 14 pounds in weight. They now hardly average above 4½ pounds and are scarce at that.

Thomas Hariot, in 1588, said: "For Foure monethes of the yeere February, March, April and May there are plentie of sturgeons and also in the same monethes of Herrings, some of the ordinary biggeness as ours in England, but the most part [shad] farre greater, of eighteene, twentie inches, and some two foote in length and better. Both these kindes of fishe in those monethes are most plentifull, and in best season, which we founde to bee most delicate and pleasaunt meate."

Notwithstanding the efforts of the Fish Commission in hatching shad and stocking the river—which is prolonging the industry—it is naturally bound, with the great increase in population and the fences of nets all the way to the ocean,

to decline. Once a seining shore on the Potomac was worth thousands of dollars, but the seines now cut out earlier each year, and the business becomes more precarious and less profitable all the time.

When the spring is backward, the weather cold and dark, the fish ascend the river in the channel, ten fathoms deep, and only come out over the netting grounds and gravel beds when the water is warm and the weather bright; but when the school makes its first excursion to the shallows it encounters a stake net, a seine, a fyke, or a drift; and these miles and miles of nets shut the fish from the upper river, while the nets in the bay even dam them from the river, so that this year's entire catch in the river was less than a quarter million, not one per head for Washington alone.

But the sturgeon, herring, and shad are not the only fish for which the Potomac was early famous. In "Superior Fishing," printed in 1865, in the chapter on striped bass, occurs the following:

> Fly fishing for Bass, however, is the perfection of the sport, and infinitely surpasses in excitement all other modes of killing these noble fish. The best season on the Potomac is in July or August, and the favorite hours the early morning or the twilight of the evening. The ignorant and debased natives who inhabit the romantic region of hill and valley in the neighborhood of Tenally Town, about five miles northwest of Washington, and who, dead to the beauties that nature has lavished around them, and utterly unacquainted with scientific angling, look merely to their two cents per pound for striped bass; manufacture a fly by winding red or yellow flannel round the shank of a large hook, adding sometimes a few white feathers. They substitute for a rod a young cedar sapling, denuded of bark and seasoned by age, and attaching to the upper end a stout cord, fish with the large flannel-swathed hook in the rapids and below the falls of the Potomac, at the old Chain Bridge, and without a reel kill bass of twenty or thirty pounds.
>
> No spot can be imagined more wild and romantic, and with proper tackle, the reel, the lithe salmon rod, and the artistic fly—no sport can be more exciting. The roar of the angry flood, the bare precipices topped with foliage on the opposite bank, the flat, dry bed of the stream where it flows during the heavy freshets, but at other seasons a mass of bare, jagged rocks, and the dashing spray of the broken current lend a charm to the scene, while the fish, rendered doubly powerful by the force of the stream, and aided by the numerous rocks and falls, have every chance to escape.

The bass pursue the silvery herring, which is the principal natural bait, and ascend the Little Falls of the Potomac during the summer months in vast numbers. They are captured in such quantities with the net in the salt water and with hook and line in the rapids, as to be almost a drug in the market.

As the season advances, the native crawls upon some rock that reaches out into the stream and with his coarse but elastic cedar pole, casts the roll of flannel wrapped round a hook and misnamed a fly, into the seething current, and when the brave fish seizes the clumsy allurement, the fisherman contends for the mastery as best he may, occasionally at the risk of a ducking in the stream consequent upon the sudden breaking of his tackle, and accompanied with considerable risk. When a man has but a slight foot-hold upon the slippery surface of a shelving ledge, and has attached to the end of his rod a vigorous fish of twenty pounds, he is apt to fall if the line parts unexpectedly. Many are the tales of such accidents, and now and then of fatal results. Generally speaking bass are not fished for with the fly north of the Potomac.

But the river is still a delight to fishermen and on a single day a few weeks ago it was estimated that 5,000 men and women were playing at fishing, lining the rocks on both banks, from Georgetown to Little Falls, and fleets of small boats dotting the stream from Chain Bridge down. Probably never in the history of the river were so many lines out in this reach, and they were cast in pleasant places, but there was a spate on and the fish were off their feed, or frightened by the invading army, and few fish were caught.

Now for the new fish that are found here. In the lower river, that is, tidewater below Little Falls, are found the red and silver ides, only caught with net and called locally sand perch. Plump tench are caught occasionally, up to a pound in weight, on worms. Goldfish are common and have gone back to original type, an olive bronze in color and nearly always mistaken for young carp. They are taken only with the net, and are a favorite bait for the big-mouth bass.

All these are only novelties and attract no fishermen, but the entire lower river is fished to brackish water for big-mouth bass, which, brought here from Illinois and reaching nine pounds in weight, have taken on entirely new habits in tidewater. These big-mouth bass were taken with a spoon in quantities every month of the past winter in the

tidal basin at the foot of Washington Monument, up to 4 pounds 10 ounces in weight—18 taken by one boat on February 22.

Native trout have always been caught in the tributaries of Difficult Run, and a couple of these little runs have been preserved and overstocked, the surplus running out into the Potomac. Dozens have been taken this season below the Little Falls, but only Simple Simon would go trout fishing in the Potomac.

In the upper river, between the two falls, hundreds of thousands of the yellow pike perch or wall-eyed pike have been planted, but so far have not rewarded the angler's efforts to locate them.

Rock bass, or goggle-eye, from the west, are common in the upper Potomac, and in seining the Chesapeake and Ohio canal one winter the Bureau of Fisheries found hundreds of these fish and restored them to the river, though not many are reported as caught in these waters. Their cousin, the warmouth perch, also introduced from the west by the Bureau, is found in every tidewater pool of the lower river, and are caught every fishing day on the fly by local anglers, using bass tackle.

Crappie there are in respectable plenty from western rivers; the upper river is full of small-mouth bass from the original stocking, before the war, from Wheeling Creek, and numerous plantings since from the Mississippi Valley; Mississippi or spotted catfish occur in large numbers about the Great Falls, of good size and growing in popularity for their gameness and flavor. With these, by accident, were also planted specimens of the fork-tailed or channel cat of the Mississippi, which reaches the weight of 150 pounds in its home waters, and has been taken here of 30 pounds.

Carp from China via Germany—that is always a red rag to the prejudiced—is a source of much enjoyment, and food to one class of fishermen, and since its young are the main dependence of the bass for food, ought to have the toleration

of the most artistic or prejudiced angler. Without them the less bass.

So, in conclusion, the native shad, sturgeon, striped bass, and even herring are flitting, and in their places the river is locally famous for a set of fishes that are imported from other climes and other waters.

REPORT OF THE COMMITTEE ON FOREIGN RELATIONS.

In this, its third report, the Committee on Foreign Relations presents to the Society certain matter relating to fish culture and fisheries in Russia, Germany, and New Zealand. The information regarding fish culture in Russia has been furnished by request by Mr. Nicholas Borodine, honorary member of the Society, and late chief specialist in fish-culture in the Department of Agriculture, St. Petersburg, Russia. The data for the German Empire are based on various articles appearing in German fishery publications and translated for the present purpose by the chairman of the committee. Some of the results of fish acclimatization in New Zealand have been communicated by Mr. L. F. Ayson, a corresponding member of the Society; and a note on the progress of fish culture in Argentina has been received from Mr. E. A. Tulian, an active member of the Society.

FISH CULTURE IN RUSSIA.

The Russian government has one central fish-cultural station at Nikolsk, Government of Novgorod, established by the well-known Russian fish culturist, Vrassky, discoverer of the dry method of artificial fecundation of fish eggs in 1854, and purchased by the government from the said Vrassky in 1869. Here is a hatchery for trout eggs—a copy of the oldest in Europe, at Huningen, Alsatia. At Nikolsk the building is of good size, but as operations are conducted along old-fashioned lines, the output is small. The station is 40 kilometers from the railroad. There are many suitable ponds for trout, also a large lake. The

scientific part of the work is well arranged. There are a biological laboratory (now, however, without a biologist) and a chemical laboratory. The laboratory has issued numbers 1 to 9 of the periodical "Contributions from the Nikolsk Laboratory," containing many good papers. At the laboratory during the summer a number of young men are engaged in the study of practical fish culture.

There are in addition three auxiliary government fish hatcheries. One is in St. Petersburg in connection with the Agricultural Museum, where rainbow trout and sturgeon are hatched; and another, with an annual capacity of 800,000 salmon eggs, is at the mouth of the Luga River not far from St. Petersburg. A peculiarity of this latter hatchery is that fecundated eggs are kept out of water. On a layer of eggs in Coste's hatching box is placed a bed of cotton, which is sprinkled with water three times a week. Of course, when the fry are nearly ready to hatch, a current of water must be supplied. This method of incubation was recommended by Dr. Oscar von Grimm and five years' experience on a large scale has demonstrated that the eggs develop well, the loss being less than in the ordinary manner. The third branch station is in Dorpat. The *Coregonus baeri* (resembling the whitefish of the United States) is hatched here, the capacity being one million. The Weiss hatching jar is used.

The above covers all that the government is doing in fish culture. The hatching of salmon on the Curo River was attempted, but without success, and the fish-cultural station established there is now closed. Experiments with sturgeon (*Acipenser ruthenus*), from a practical standpoint, were a failure.

There is no station for carp culture, although for a long time the establishment of one has been under consideration. The government has made no appropriation for this work, but it is hoped that in time there will be a station for distributing carp fry—a matter of great importance to certain districts. In Poland and Estland there are a large number

of very good carp ponds, but none that are operated by the government. The work at these private ponds is in general very well done.

As fish in Russia are becoming very scarce and high in price, Mr. Borodine is endeavoring to have fish-cultural work conducted on a large scale under an organization like the U. S. Bureau of Fisheries. There is no special bureau for fish culture, such work being attended to by the Department of Agriculture, one of the branches of which is in charge of fisheries, fish culture, game culture, bee culture, and the rearing of silk worms. Only 5 persons are engaged in all this work, 3 being specialists in fish culture and fisheries, and one inspector of fisheries, all consulting specialists with no defined duties. Beginning with 1907 an advisory fish committee was organized at the Department of Agriculture; the members are special officers of the department and two are also representatives of the Russian Fisheries Society.

The Russian government appropriates about 800,000 roubles (1 rouble=about $0.55) annually for fish culture, exclusive of the salaries of regular employes, whose compensation ranges from 600 roubles for fish culturists to 3,000 roubles for the chief specialist.

The output of the hatcheries is generally distributed as fry. There is no gratuitous distribution, but a charge is made at the rate of about 3 roubles for 1000 fertilized trout eggs or for 100 fry. The transportation facilities by railroad are so poor and the cost so high that the eggs and fry are bought only by very wealthy men.

Data showing the extent of fish culture in Russia are very incomplete. The annual output is very small, as may be judged from the following statistics of the fertilized eggs in the Nikolsk hatchery and its branch at St. Petersburg:

Year.	Salmo salar	Salmo truttæ	Salmo salvelinus	Coregonus baeri
1881	65,000	64,800	2,500	401,500
1895	150,000	200,000	2,000	500,000
1898	80,000	220,000	3,000	1,000,000
1901	85,000	200,000	10,000	1,000,000
1903	———	200,000	———	1,200,000

The number of private fish hatcheries in Russia does not exceed 10 to 12. They handle the same species as the government stations, but their output is not known. Practical results from both private and government work are reported to be insignificant. American rainbow trout have been introduced in Kiev from Germany, catfish in Nikolsk for aquarium culture, and large-mouth black bass in limited numbers in a few places.

FISH CULTURE AND FISHING IN GERMANY.

Germany undoubtedly leads all European countries in the extent of its fish-cultural work. Statistics collected in 1895 show that in the entire German empire there were at that time 12,623 persons engaged in inland fisheries and fish culture, and 71 per cent of these, or 8,956, made this their principal occupation.

Fish culture in Germany is mainly a matter of private enterprise, and the sale of fish for food is the ultimate source of the fish culturist's income and support. Many districts in Germany are thickly sprinkled with natural lakes, which are largely utilized, and there is a very great area of artificial ponds.

The fishes cultivated belong to many species, grouped in several families, mainly the Salmonidæ and Cyprinidæ. Two leading fish journals, in their issues of January, 1909, contained the advertisements of 103 persons or firms offering for sale young fish and eggs for stocking purposes: 9 of them offered Salmonidæ in general; 54 specified European brook trout; 41 American brook trout; 2 sea trout; 2 lake trout; 43 rainbow trout; 4 purple trout; 3 European saibling; 1 coregonoids; 4 grayling; 1 Danube salmon; 34 carp; 24 tench; 7 goldfish; 2 higoi (a kind of Japanese

goldfish); 1 American sunfish; 2 black bass; 2 small-mouth black bass; 2 stone bass; 2 pike; 4 pike perch; 2 American horn pout; and 5 eels.

An inspection of nine issues of three fishery journals in January and May, 1909, discloses the advertisements of 20 persons or firms offering fish food for sale, under the following names: fish-roe, fishmeal, "fishmeal aki", fishmeal "Ideal", Hering's fishmeal, Schlutup fishmeal, Naegel's fishfood, fleshmeal, food-fish-meal, food-flesh-meal, "Radical pond food", rice-food-meal, rye-food-meal, lupines, "Lupiscin", "Cyprinin", etc. In several instances the above advertisers state the composition, in part, of their food articles. For instance, the "Fishmeal Aki" is said to contain 60 to 70 per cent phosphate of lime; the "food-fish-meal" 65 to 70 per cent protein. Lupiscin is a patented article composed largely of lupines. Cyprinin is a mixture consisting of 40 parts lupiscin, 40 parts fishmeal and 20 parts loam (or clay). Apparently there is good sale and extensive use of many of these articles.

In the markets many species are sold for consumption, those from fresh water in a single market report in June being carp at 77 to 92 marks for 50 kilograms (or 8 1-2 to 10 cts. per lb.); tench at 23 to 102 marks (or 2 1-2 to 11 cts. per lb.); pike at 25 to 123 marks (or 2 3-4 to 13 1-2 cts. per lb.); eels 21 to 135 marks (or 2 1-4 to 14 3-4 cts. per lb.); and salmon at 92 to 121 marks (or 10 to 13 1-4 cts. per lb.). The favorite way of selling fresh-water fishes in Germany is from tanks of water, alive, and the lowest price quoted above is in each case the price of fish not sold alive, except the carp, of which no dead fish were offered that day, and salmon, of which only iced fish were on the market.

There are many fishery societies in Germany, nearly all of them being especially interested in fish culture. The leading society is the Deutsche Fischereiverein, which geographically covers the whole realm. Other general societies are the Seefischereiverein (or Society of Sea-fisheries); the

Verein Deutscher Teichwirte (or Society of German Pond-culturists); the Verein Deutscher Fischhaendler (or Fish Dealers' Union); the Verein der Fischindustriellen Deutschlands; and the Verein der Privatbeamten der Teich-wirtschafts und Fischereibetriebe Deutschlands (or Union of Private Officers of Fish Ponds and Fishing). There are upwards of 50 societies of a more local character that are sufficiently active to have their proceedings reported in the journals. There is also a general council of fishery societies, the Fischereirat, which meets annually, from whose pro-ceedings in June, 1909, extracts are here given.

There are four fishery journals published in Germany twice a month or oftener, besides one in the German language in Austria and another in Switzerland.

Instruction is given by courses of lectures and demonstra-tions ("Lehrkurse") and by traveling boards ("Wander-lehre"), the officers of which can be summoned to make local examinations as the basis of advice on questions of fish culture. Of these lecture courses there were ten announced in the Allgemeine Fischerei Zeitung in 1908, and two of the traveling boards were advertised.

Public support of fish culture is given from time to time in the form of subventions to the fishery societies, the German Fischereiverein acting usually as an intermediary, dividing the subventions when necessary among the minor societies. These subventions are generally made for specific purposes. Thus, in 1908 the imperial government granted 21,780 marks for the following purposes:

For distribution of salmon and sea trout in the littoral districts of the Baltic Sea, 3,000 marks ($720); for the importation of eel fry from England for the stocking of German waters, 8,500 marks ($2,040); for the production and liberation of salmon fry in the Rhine and its tributaries, 3,959 marks ($950); for the production and distribution of salmon fry in the Elbe and tributaries, 5,571 marks ($1,337); and for the investigation of north German waters, 750 marks ($180).

A fishery convention resulted from the assembling at Dresden in June, 1909, of the German Fischereirat, the German Fischereiverein and the Saxon Fischereiverein, the last in celebration of its twenty-fifth anniversary. The Fischereirat held its seventeenth session, and considered a number of matters of special importance, including reports on the fish-cultural work of the affiliated societies, on the introduction of eels, on problems in pond culture, etc.

Following is a summary of the fish planted and eggs furnished by the affiliated German societies under imperial subventions aggregating 34,000 marks, as reported at the Dresden convention:

Species.	*Number.*
Grayling	40,000 eggs; 45,000 fry.
Rainbow trout	98,450 fry; 8,900 yearlings.
Lake trout	1,600 yearlings.
Lake saibling	12,000 fry; 1,800 yearlings.
American brook trout	34,000 fry; 250 yearlings.
European brook trout	99,000 eggs; 657,000 fry, plus fry for 250 marks; 12,000 yearlings, plus yearlings for 250 marks.
Danube salmon	1,100 yearlings.
Whitefish	517,000 fry; 1,512 yearlings.
Pike	7,500 fry; 1,590 yearlings, plus yearlings for 50 marks.
Carp	1,025,000 fry, 51,000 yearlings, plus yearlings for 625 marks; 5,614 2-year olds, plus 2-year olds for 65 marks; 2-year olds of 2,170 pounds weight; 230 3-year olds; 60 spawners.
Tench	10,016 yearlings; 2,600 2-year olds, plus 150 pounds weight.
Pike perch	32,000 fry, plus fry for 140 marks; 30,020 yearlings; 200 pounds of spawners.
Eel	1,000 fry, plus fry for 234 marks; 18,000 fingerlings, plus 13,500 pounds of fingerlings.
Plaice	10,000 eggs.
Crawfish	15,100, plus crawfish for 41 marks.

The propagation and distribution of salmon and sea trout under the direction of the German Fischereiverein and allied societies had the following extent in 1909. In the Rhine district the salmon-egg harvest was extraordinarily large, and contrary to the usual experience the lower Rhine as well as the middle and upper districts was very productive.

Waters stocked.	*Number.*
Rhine and tributaries—salmon fry	1,994,740
Elbe and tributaries—salmon fry	1,239,058
Weser and tributaries—salmon fry	1,257,749
Ems and tributaries—salmon fry	196,350
Oder and tributaries—salmon fry	30,000
Weichsel and tributaries—salmon fry	116,950
Baltic Sea and tributaries—salmon fry	126,940
Baltic Sea and tributaries—sea trout fry	134,260
Baltic Sea and tributaries—sea trout fingerlings	19,500
Total	5,115,547

CHINOOK SALMON IN NEW ZEALAND.

Extracts from a letter from L. F. Ayson, Commissioner of Fisheries, Wellington, New Zealand, dated August 30, 1909:

You will be pleased to learn that the chinook salmon are showing up first rate in our rivers. Several have been caught by anglers during the trout season at the mouth of the Waitaki River, and we had quite a good run of spawning fish up in 1908 and again this year. The first spawning salmon came up in 1906, and the run has been better every season since then. We find that most of the fish spawn in the large tributaries of the Waitaki and in the main river itself; and we have traced them right up to the lakes at the head of Tekapo River and through Lake Ohau, and have found them spawning in the rivers which flow into the lake. Very few fish come into the smaller streams, such as the Hakataramea, to spawn; and as it is only in the smaller tributaries that we can trap or net them our collection of eggs has not amounted to much. This season we took 238,000 eggs from fish ranging from 8 to 26 pounds in weight. The eggs were as large as those

we imported from Sacramento salmon, and they hatched out splendidly. So far we find that the salmon begin to spawn about the second week in April, and that they are all finished by the end of May. These months would correspond with October and November with you. Would you call this an autumn or winter run? I understand that all the salmon eggs we had from America were from winter-run fish.

You probably know that we put all the salmon hatched from imported eggs into the Waitaki River, and we now find the fish spreading along the coast and going into other rivers. Young salmon of one pound weight have also been caught by fishermen in some of the bays along the east coast, so there is every probability of all the rivers which are suitable along that section being stocked with them.

PROGRESS OF FISH CULTURE IN ARGENTINA.

An interesting note on some of the results of fish acclimatization in Argentina has been sent by Mr. E. A. Tulian, national fish culturist. The first fish eggs were hatched in this country in January, 1904; and an account of the inception of the work appears in a previous number of the Transactions. Under date of June 3, 1909, Mr. Tulian wrote that up to that time the season's take of American brook trout eggs was 300,000, and that 200,000 to 300,000 additional eggs would probably be obtained. These eggs are from wild fish. Many fine examples of brook trout and land-locked salmon have been caught, one female brook trout weighing 5 pounds and measuring 18 inches, and a female land-locked salmon measuring 16 inches in length; these fish had recently spawned. At another stream several brook trout 14 inches long were taken, one a female full of eggs. The trout have been planted from the streams of the Andes directly north of the Patagonian border of Argentina to its most northern province, which is entirely in the tropics; the mountains being so high as to have snow to keep the streams cool in mid-summer of a tropical climate.

QUESTION BOX.

QUESTION 1.—What advancement has been made in small-mouth bass culture since last year?

MR. CLARK: While perhaps as near as I can determine there has been no marked progress, we have had an experience at Northville that seems to merit more than passing notice. We now have some two-year-old small-mouth bass raised at Northville that spawned this spring. They are fish reared from fry hatched two years ago in our ponds. This season they spawned. Possibly this may be considered an advancement in small-mouth bass culture. In any event I believe that hereafter we should get our breeders by raising them.

MR. JOHN W. TITCOMB: From my office at the Bureau of Fisheries in Washington I can see marked progress in a general way in the propagation of small-mouth black bass, simply in the results attained. It is no longer the problem that it was when first undertaken only a few years ago. The small-mouth bass is just about as easily propagated as the big-mouth bass and some think it is even easier. We are producing a large number of fingerling small-mouth bass. This year the output will be much greater than ever before.

PRESIDENT: May I be permitted to call attention to one thing in relation to the small-mouth black bass that may not be known to all of our members. Up to a year or so ago we in New York were under the impression that the small-mouth black bass especially could not be placed in ponds just prior to the spawning season and produce a good crop of young. During the last two years at the Chautaqua Station, and at the Constantia Station on Oneida Lake, we took bass from Chautauqua and Oneida Lakes just about when they were ready to spawn, or a day or two in advance of actual spawning, and put them into the pond prepared for spawning, and they went ahead about their business just as though they had lived there all their lives. We were very greatly surprised and gratified at this, for now we are not obliged to keep a great stock of brood fish in our ponds. We simply go to the lake, take out the fish when they are gravid and almost ready to spawn, put them into the ponds, get the young, and then let the old fish go. We are under no expense for the care or watching of the fish during the winter or at any time. Another thing which surprised me somewhat was the late date of spawning of the small-mouth bass at Constantia, New York. We took two nests of young which were just hatched on the 2nd of July, and I learned that the spawning actually continued beyond the middle of July.

MR. DWIGHT LYDELL: We have put into practice at the Mill Creek station during the past two seasons a plan that has proved so successful that every bass nest is productive. In the fall we put our brood fish into a storage pond which is deeper than the others, and the fish are held there until just before they are ready to spawn. There are no nests or spawning places in this pond and the fish are too much crowded to spawn even under more favorable conditions, and they are held there with a big flow of water until danger of the spawn being destroyed by cold weather is past. In the meantime spawning ponds are prepared, nests set and everything made ready for the time when spawning cannot be postponed any longer. This season it was the 11th of May before we decided that the fish must be put into the spawning ponds. Within four or five hours after they were transferred nearly every bed had been spawned on and every bed used produced fry. The fish had plenty of minnows in the storage ponds, all they wanted to eat, and were in the pink of condition when put into the spawning ponds. Results were highly successful. There was not a single unproductive nest out of 75. Of course in a latitude where the water warms up and stays warm, results would no doubt be satisfactory without holding the fish in a storage pond. At Mill Creek, however, we almost invariably have several days of cold weather following a period warm enough to induce spawning. Again, early in the season we are liable to have days when the water warms up enough in the middle of the day to cause the fish to spawn, yet during the night it becomes so cold that the eggs are killed. In a word, the idea or plan of crowding the parent fish into a storage pond is to prevent or postpone spawning until we are certain that the temperature of the water will not drop below the danger point. Perhaps this plan is not necessary at southern stations or in warmer latitudes, but it works out very successfully in the northern part of the country.

QUESTION 2.—Has any new method been discovered for removing algae from water?

MR. TITCOMB: I suppose the question has reference to some other method than the use of copper sulphate.

PRESIDENT: Yes.

MR. TITCOMB: I know of none.

QUESTION 3.—Should minnows be introduced into black bass breeding ponds as food for the bass?

MR. LYDELL: During the spawning season we do not allow anything there but adult fish. The minnows would be very detrimental to the young bass. We put no minnows in our breeding ponds at any time of the year unless they are dead. The fewer live minnows you have in the pond the more natural food there will be for your bass fry.

MR. CLARK: At what period do you introduce food for your adult fish?

MR. LYDELL: Do you mean minnows in the storage pond?

MR. CLARK: Yes.

MR. LYDELL: In the fall of the year and at no other time. Just now we are feeding liver to the adult bass.

MR. TITCOMB: Would you introduce the minnows in the fall of the year?

MR. LYDELL: We put large numbers of live minnows in our storage pond every fall. What the bass do not eat in the fall they have when they come out of winter quarters, but when the breeders are put into spawning ponds they have no live minnows. They spawn at once and we commence feeding them immediately after screening the beds. Many fish culturists forget their old fish after they have their young. The parent fish must be well fed in order to produce a nice lot of fry the next season. It is necessary to begin feeding right away after spawning.

MR. CLARK: Mr. Lydell breeds both large and small-mouth bass. We breed nothing but the small-mouth at Northville, so anything I say applies to small-mouth only.

MR. LYDELL: My statements also refer to small-mouth bass.

MR. CLARK: At Northville we handle small-mouth bass in much the same manner as described by Mr. Lydell. The fish are put into a storage pond in the fall with plenty of minnows, and when taken out in the spring they are given no minnows. At other times the food is principally liver. Possibly a few minnows are fed if the fish get a little thin on the liver diet. With reference to the question of liver, why should we not feed it extensively to small-mouth bass the same as to trout? There is no difference between feeding small-mouth bass and trout, so far as I can see.

MR. JOHN E. GUNCKEL: Why is it that when these educated, liver-fed black bass which you deposit in the streams are fished for with liver by my class of people we cannot catch a black bass, but land instead a catfish or bullhead?

MR. CLARK: We do not distribute our adult liver-fed fish. The little fish, the fingerlings, never have any artificial food.

MR. W. H. SAFFORD: Where do you get your stock fish from?

MR. CLARK: I just stated that we are now raising them ourselves. Heretofore we have taken them from native waters, but hereafter we propose to raise them.

MR. SAFFORD: Were your wild fish fed with liver from the beginning?

MR. CLARK: We got them to take liver as soon as we could.

MR. SAFFORD: We have both the large and small-mouth bass but cannot induce either species to take liver at any time of the year.

MR. CLARK: Then you are not using the right kind of liver.

MR. SAFFORD: We have both the beef and the pork.

MR. LYDELL: Your liver is out of order. (Laughter.)

QUESTION 4 (by Mr. Titcomb).—In the propagation of either large or small-mouth bass, have any of you found that tadpoles take possession of the nests to such an extent that the parent fish leave in disgust, and the eggs are spoiled and eaten by the tadpoles?

MR. SAFFORD: Not that I have noted.

MR. TITCOMB: Let me give you the experiences of two or three of the Bureau's superintendents. The superintendent at Erwin, Tennessee, thinks tadpoles consume quantities of eggs and that the frogs eat fry. Mr. Seagle, of the Wytheville, Virginia, station, does not believe that the tadpoles destroy good eggs, and he looks upon them as desirable scavengers. Mr. Robinson, superintendent of the hatchery at White Sulphur Springs, West Virginia, first brought the matter to my attention in the propagation of small-mouth bass. Mr. Robinson says he regards the tadpoles as very destructive, for they swarm in large numbers around some of the nests, and as far as he has been able to observe, the nests so surrounded have not produced a single fish. I tried to ascertain whether the tadpoles took possession of nests of blighted or poor eggs but was unable to do so. Mr. Johnson, of the Manchester, Iowa, station, states that apparently they do no harm except perhaps a few days before the bass spawn, and that they are too small to do serious damage to the eggs. He states that they frequent shallower portions of the pond and do not go into deeper water until quite large. He thinks they may consume minute animal life which would serve as food for the bass. Mr. Carter, of the St. Johnsbury, Vermont, station, never regarded them as enemies, but fears they consume vast numbers of insects that would otherwise be valuable as food for the fish. He thinks it well to raise frog tadpoles in separate ponds and says that the bass will not touch the tadpoles of the toad. But the information from Mr. Robinson is quite convincing that tadpoles sometimes become so numerous that they actually take possession of bass nests. I should like all who are interested in pond culture and have an opportunity to do so to make observations along this line, especially because it seems to me a great reflection on the bass if he allows tadpoles to take possession of the nest while he is on guard.

MR. H. D. DEAN: I have seen a strawberry bass rid his nest of tadpoles by sucking them into his mouth, swimming away from the nest and then ejecting them. I do not believe any of the basses will take toad tadpoles. Last Monday we drew down a pond of strawberry bass and found almost as many frog tadpoles as bass. I do not believe they do any harm unless through eating minute animal life, nor do I think they drive black bass off the nests.

MR. W. E. MEEHAN: The toads are so abundant at one of our stations that they are a nuisance. The bass do not seem to touch them but they clean up the frog tadpoles quite lively in other ponds; there is any quantity of toad tadpoles in the bass ponds untouched.

MR. LYDELL: Does Mr. Titcomb refer to the frog or toad tadpole?

MR. TITCOMB: Both.

MR. LYDELL: I consider them a nuisance, because they prey on good as well as poor nests. The tadpoles were often so numerous around the nests that we have thought at times when screening a nest that there were more of them than bass. Some three years ago I found that by going out in the evening with a lantern we could easily gather up the adult toads. In a single evening with the help of two men I gathered up a common sugar barrel full, which did away with the tadpoles for that season.

MR. SAFFORD: Do you mean the term tadpole to include the toad as well as the frog?

MR. TITCOMB: Yes, the toad eggs are produced in the water the same as frog eggs.

MR. SAFFORD: The term tadpole applies exclusively to the frog, according to my understanding.

MR. MEEHAN: There is a tadpole of the toad also.

MR. LYDELL: Every year before the spawning season we prevent the tadpole nuisance in the manner described above.

MR. CHARLES W. BURNHAM: Did you remove the eggs that were spawned by the toad, too?

MR. LYDELL: If any were there we did. They are found in long strings and may easily be gathered up and destroyed.

PRESIDENT: We have done it for years.

MR. JOHN E. GUNCKEL: I fish a great deal in the upper waters of the Maumee. We have both the small-mouth and the large-mouth bass, but the large-mouth are quite plentiful in the big pond a few miles above the rapids. When the tadpoles are of good size, we go up on the rapids and catch more bass than with any other kind of bait. I refer to the common green frog tadpole. I have not time to tell you how large fish I catch. I will tell you that later. (Laughter.)

QUESTION 5.—What number of adult black bass brood fish per acre is considered best to produce the largest number of fingerlings numbered 1½ and 2?

MR. LYDELL: That is a very hard question to answer. At the Mill Creek station we get the largest number from 40 to 50 pairs; at some other bass stations it might require a much larger number.

MR. WARD T. BOWER: This question relates I believe to the large-mouth bass, although it merely states black bass on the slip before me.

MR. MEEHAN: It is generally understood as meaning the small-mouth.

MR. WARD T. BOWER: At the Washington office of the Bureau of Fisheries the expression "black bass" refers to the large-mouth, and when the small-mouth is meant it is so specified.

MR. MEEHAN: In Pennsylvania the local phrase is black bass for small-mouth bass.

MR. FULLERTON: How many feet apart would you put the nests?

MR. LYDELL: We used to put them ten, then twenty, and now thirty feet apart, and are getting more fish at present than when they were ten feet apart. Formerly we put thirty or forty pairs of bass in a pond 60 by 150 feet; but now we use only fifteen pairs and get more fingerlings and more good nests than ever before. I am speaking of small-mouth bass. Of large-mouth bass we had last year twenty-five pairs in a pond 300 by 250 feet, and got about 225,000 number 1 and between 15,000 and 20,000 number 2 fingerlings. This year we increased the number of brood fish, putting in sixty pairs, and as a result we have taken to date only about 30,000 number 1 and no number 2 fingerlings. There are only a few left in the pond, which shows that the increased stock of brood fish decreased the output.

MR. FULLERTON: That bears out our experience in Minnesota. We overstocked at first with too many breeders, which I realize was a mistake. I agree with Mr. Lydell that more bass will be produced if the nests are placed thirty feet apart.

MR. WARD T. BOWER: This question as to the proper number of brood fish per acre depends to a large extent on local conditions. There is no advantage in hatching more fry than the natural food supply will support.

MR. LYDELL: The number of adult fish or fry in a pond depends entirely on its condition. In some ponds where food is very plentiful we get double the number of fingerlings that we do from others twice its size, simply because there is twice the amount of food. Every fish culturist must be his own judge on this point.

QUESTION 6.—Have any experiments been undertaken towards the propagation of aquatic food for fish in streams?

MR. MEEHAN: As the one who put this question in the box, I may state that in Pennsylvania we are in a rather peculiar position, or rather a good position in one sense, in that we are beginning to prevent the pollution of the streams. At one time in Pennsylvania we probably had the worst polluted streams of any state in the country, but in the last two or three years there has been a change of sentiment. The people do not now believe in making their streams open sewers; and the Department of Health and Department of Fisheries have in hand the purification of the waters. The laws are very sweeping and strong, and we are beginning to prevent pollution. Over one hundred establishments have been cleaned up by the Department of Fisheries within the last two months, and it comes now to a question with us, as we get the streams clear, of providing food for them, because if the food is not there we are not going to have fish. Has anything been done or have any experiments been carried on with a view of restoring food life in the waters in the shortest possible space of time? Of course I am well aware that certain aquatic plants like chara and fontinalis grass

and certain potamogetons are good food producers, but even that is not enough in some instances for us; and I should like to know whether anything has been done along this line, or in the line of propagating minnows, crayfish or anything else that would produce fish food.

PRESIDENT: Are there any further remarks on the question of the propagation of aquatic food for streams?

MR. MEEHAN: Has the Federal Bureau done anything in this direction?

MR. TITCOMB: No, I think not. We are now collecting aquatic plants from our trout stations, and propose to collect them from certain trout streams, with a view of gaining further knowledge as to which plants are best and which may be considered objectionable; also as to how to regulate their growth, somewhat on the same order as the work which resulted in a paper on aquatic plants in pond culture. I wish to explain, by the way, that this is a subject that I know very little about, and made bold to write on merely to bring out the fact that so little is known, and in the hope that some plant physiologist will take up the subject and go on with it for two or three years or until we know definitely more about it.

MR. MEEHAN: I would like to illustrate particularly what I am after and where I need the assistance of the Society. We have, for instance, among other streams in Pennsylvania, one known as the Clarion River, which rises in Elk County and flows through that county for many miles, and is for part of the distance quite a large stream. There is today not a living thing in it from source to near the mouth. All life has been destroyed by pollution from paper mills, tanneries, chemical works and things of that sort. Now, we hope to have this river clear inside of the next twenty-four months, so that it may be in a condition to support fish life, which of course cannot be maintained unless food is there. It is not a trout stream except in the extreme upper end; but warm water fishes will live in the main river, and its possibilities are very great given the absence of pollution. Looking forward to this work, I am very anxious to have the advice of the Society as to methods of food propagation, because it will be necessary for us to establish aquatic life to support fish life in streams, particularly like the Clarion River. It is a herculean task before us, but it is one that should arouse the interest of everybody in the work.

MR. FRANK M. MILLER: How are you going to stop the pollution?

MR. MEEHAN: By fining those who violate the law.

MR. MILLER: What will you do with the pollution?

MR. MEEHAN: It is not a question of dollars and cents, and besides, it can be used at a profit; it is a question of aquatic food, and that is above dollars and cents.

PRESIDENT: I suppose Mr. Meehan will agree that insect life will come without help on the part of man, but the plant life will have to be introduced, also some crustaceans and shells perhaps.

DR. EVERMANN: The best thing will be to provide as early as possible certain places along the river where plant life may be established—

marshes that connect with the river, and coves where vegetation cannot be carried away.

MR. MEEHAN: We are nearly rid of refuse from tanneries along that stream, and this is one of the worst forms of pollution. A large paper manufactory has received notice to put in a separation vat within sixty days.

QUESTION 7.—Are applications for fish increasing or decreasing annually?

MR. TITCOMB: In the year 1902 when I first took my position in Washington, D. C., we averaged something like 2,500 applications for fish annually. The number received each year has steadily increased until the fiscal year just ended showed something over 10,000. Had we recorded them as we did in 1902 the number would have been much greater, for at that time it was common for a dozen or twenty applications to be filed for a single lake, while today we file only one application, cancel the others and notify the applicant of the action taken.

MR. FULLERTON: That is the case in Minnesota. Applications have increased fifty per cent in the last ten years. In regard to applications received by the government I believe it would be a good plan for the Bureau of Fisheries to refer them to the boards of fish commissioners of the several States for recommendations. The Bureau of Fisheries may not be in a position to know as well as local fish commissions what kind or kinds of fish are best adapted to the waters applied for; hence I believe that the local boards should be consulted.

MR. TITCOMB: We are taking more and more precautions every year to see that fish are not wasted. When there is any doubt about the suitability of a particular species of fish for any definitely named body of water, as described on the application, it is referred to the commissioner of fisheries of the State in which this water is located. In addition to this precaution of referring the applications to State fish commissioners where there seems to be some doubt as to the advisability of granting a request, or where the applicant is very persistent and is dissatisfied with the species assigned, the Bureau is making a card index of all the important waters for which fish are supplied. To the extent that we can secure the information the results of plants are entered in the card index three or more years after the fish are delivered. To obtain the information special inquiry blanks are distributed to those who applied for or planted the fish. This, of course, is a big undertaking, but I believe that the government can well afford to devote considerable time and money to the compilation of such an index. In the course of time the Bureau will thus have a valuable record of the results of its work. I think when you appreciate the amount of work being done in this direction you will realize that the Bureau is taking every possible precaution to see that the fish are not wasted.

MR. FULLERTON: What I said about the Bureau was not in a spirit of criticism as I think it is doing a great work. I suggested the reference

of applications to State boards with a view to making the Bureau's work still more effective. In Minnesota we have adopted this card system and have been working at it three years. Every lake and stream in the State is now indexed. We know their depth, size, the kinds of fish in them, etc.

MR. SEYMOUR BOWER: In Michigan the number of applications has increased rapidly and particularly in the last five or six years. We use a blank form of application and three to four thousand of these are filled and returned yearly. This does not include hundreds of renewal requests nor requests to make applications perpetual. We also fill brook trout applications three successive seasons whether reapplied for or not; so that in one way or another we have from 5,000 to 7,000 requests and applications before us for consideration annually.

MR. MEEHAN: Applications for fish in Pennsylvania are increasing very rapidly. The number last year for black bass was only half what it is this year. The demand for trout is also increasing. We do not renew an application; a blank must be filled out for each lot of fish. Requests for an extra supply of fish are likewise increasing. It is not uncommon for an applicant to ask for forty cans of fish for a mile of stream.

PRESIDENT: The applications for fish are increasing rapidly every year in New York. Last year we had more than four thousand, which is about one thousand more than the year before.

DISCUSSION ON YELLOW PERCH

MR. WARD T. BOWER: It occurs to me that the yellow perch is well worth consideration at this time. I may be something of a yellow perch crank even as we have our bass and trout cranks. If so, my enthusiasm is due to the high place which I think this excellent food and game fish deserves. In order to stimulate a little discussion, I have at the suggestion of Dr. H. M. Smith, of the Bureau of Fisheries, brought a jar containing some yellow perch ova, which perhaps you will be interested in seeing. As you will notice, the eggs are in the form of strings or ribbons. These are green eggs and they retain this general appearance practically throughout the period of incubation. It is interesting to know that generally a yellow perch weighing say a pound will deposit a ribbon of eggs which a few hours afterwards will weigh twice as much as the fish. Contrary to the general belief that yellow perch eggs are embedded in or held together by a membrane, you will observe, upon careful examination, that they are merely attached one to the other; and after hatching there is practically no residue. In hatching jars the ribbons stand up very much after the fashion that they do in this container. I think it was Mr. Clark who told me that he had difficulty in supporting the ribbons in jars. Often they collapsed and fungus and other troubles developed to the extent that the eggs were practically a total loss. This may have been due in a measure to very cold water or other unfavorable conditions, but so far as I know these troubles have not been experienced elsewhere. I trust that we may have a free discussion on this point.

It is worth noting that we have changed the standard of measurement for yellow perch eggs. In a report issued twelve or fifteen years ago I think the statement is made that perch eggs measure at the rate of 28,000 per quart. At the present time the Bureau is recording them at the rate of 130,000 per quart, quite a difference from the early standard.

MR. TITCOMB: I was thinking that it was a little less than that.

MR. WARD T. BOWER: Quite recently it was determined by actual count and otherwise that the average number per quart is 130,000.

MR. MEEHAN: In our measurement we made between 70,000 and 80,000, but I dare say you have been able to give more time and study to it than we did. I know the Bureau is not apt to over measure its eggs.

MR. WARD T. BOWER: No doubt there is considerable variation in the number per quart, according to locality, size of fish, etc., as in the case of brook trout.

MR. TITCOMB: I think that 100,000 is a very conservative measurement.

MR. MEEHAN: What is the longest ribbon you have seen in your experience?

MR. WARD T. BOWER: Eighty-eight inches, I think.

MR. MEEHAN: Our longest string was seven feet four inches—same length. It weighed nearly five pounds. Do I understand that there has been some trouble in handling yellow perch in jars, and that a fungus growth has prevented the eggs from hatching?

MR. WARD T. BOWER: I have not seen anything of the kind, but Mr. Clark told me a short time ago that he has experienced some such difficulties.

MR. MEEHAN: We had little or no trouble in handling the eggs either before or after they were put in the jars, provided we did not put too many in a jar. A Downing jar will carry four quarts safely and with no tendency to settle. At a certain period after the strings separated the eggs had a tendency to rise like dough and go over the top of the jar. This was overcome by putting a piece of mosquito netting around on the inside of the jar. If further trouble was experienced we turned the water off and allowed the eggs to settle, after which the water was slowly turned on again. Sometimes they would rise a second time, but not often. Occasionally the mass of eggs would get thick and when hatched the fry had some trouble in getting free of the mass, but the loss was very small, not worth considering. If the eggs were dirty we washed them. The dead eggs were removed without injury to the rest. This cannot be done with pickerel eggs. You cannot touch the latter after they are in the jars. We found that neither yellow perch nor chain pickerel eggs could be successfully hatched in spring water. They would die within twenty-four hours, whether the temperature of the spring water was 48, 50 or 52 degrees Fahrenheit. If the spring was far enough away for the water to become aerated there was no trouble.

MR. WARD T. BOWER: We have had very little difficulty in the propagation of yellow perch. At the Bryan Point station on the Potomac River, where several hundred millions were handled this year, the percentage hatched was over ninety-five.

MR. MEEHAN: We get about ninety-five per cent of hatch.

MR. WARD T. BOWER: In addition to its direct value as a food and game fish, the yellow perch is very prolific and therefore furnishes an important source of food for black bass and other predaceous species.

MR. MEEHAN: At my suggestion, the Blooming Grove Park Association in Pennsylvania has put up a hatchery to hatch large numbers of these fish.

MR. TITCOMB: I understand that the yellow perch is perhaps more easily propagated than any other species. Simple methods and apparatus answer the purpose, and a large flow of water is not necessary. The eggs may be hatched in an aquarium, a trout trough or any equally simple device; but to handle the eggs to the best advantage and with a knowledge of just what you are doing, the open jar seems to be the best. The Bureau is now hatching them in this manner at several stations.

And by the way, speaking of propagating perch as food for bass, one

of the men at a field station has been transferring perch fry to a station pond and raising them for bass food.

MR. WARD T. BOWER: The reason why I referred to possible troubles in connection with the propagation of yellow perch is that Mr. Clark has on two or three occasions called attention to the difficulties experienced in handling the eggs in jars, and I thought this might bring out something of benefit to him and others who may have had similar troubles.

MR. CLARK: Our experience in hatching yellow perch has been so limited that I do not think it is of any great value. I may say, however, that Mr. Thayer, foreman of the Detroit hatchery, placed the eggs in jars and undertook to hatch them in the way that is said to be so easy and they all died. However, when we suspended the ribbons in the jars we hatched from 80 to 95 per cent. At any rate we assumed that we hatched about 90 per cent because this proportion showed the eye spots and the moving fish. No doubt as Mr. Titcomb says it is an easy matter to hatch perch eggs provided the ribbons do not settle to the bottom of the jar.

MR. MEEHAN: We do not string the ribbons across the jars but put them in the same way as other eggs, and we have no trouble at all.

MR. CLARK: I would like to hear from Mr. Lydell on this subject.

MR. LYDELL: I did not intend to say anything about the yellow perch. I am hardly ready. We have been experimenting with them at the Mill Creek station a couple of years and have five hundred breeders there at and the fry. The eggs hatched most successfully the past season and were handled in this way: we placed two ribbons in each jar and kept them there until two or three days before hatching, when they were transferred to our large fry tanks. Seine twine was strung back and forth across these tanks about an inch apart and the same distance from the bottom, thus forming a rack for the ribbons to cling to or rest on. When everything had disappeared from the twine we knew we had a large hatching percentage. But when we held the eggs in the jars until they hatched, the fry in the bottom found it very difficult to swim up through and escape from the gelatinous mass. They became tangled up and smothered. Nearly half of the hatch was lost in this way, which is not very profitable.

This season I tried a galvanized tank for hatching perch. This tank has three sets of wire trays in it, half inch mesh, on which the spawn is placed. The water is introduced from the bottom of the tank, which is rounding, and in such a way as to insure uniform circulation. This worked to perfection until the eggs hatched, when if we did not take the fry out they commenced to die. Then I introduced another pipe to carry the young fish up and out with a strong current of water. This worked well with not to exceed a million of eggs in the tank. But that is not entirely satisfactory, because we want a tank that will handle 10,000,000 eggs.

We hatched and distributed five or six million fry at Mill Creek this year, and are now working on a plan to raise them to fingerling

size before shipping. We have shipped 20,000 number 2 fingerlings and have 10,000 to 15,000 on hand. They take ground liver readily, are now two and one-half inches long and growing very fast. They come into shallow water and feed freely from the bottom of the pond. We are much encouraged in the work.

MR. TITCOMB: I wish to supplement my remarks about how easily perch eggs are hatched by saying that where one is not particular about knowing the actual number hatched, perhaps the simplest and most economical method of handling them is in floating boxes. Go to any lake or river where perch are taken during the spawning season, put your floating boxes in, fill them with eggs and let nature take its course. You simply save the eggs and protect them until they hatch.

MR. S. W. DOWNING: Mr. Titcomb's method is all right if the water is clear, but if it is as roily as it was this season in Lake Erie, the eggs will become so loaded with silt that they will settle to the bottom and smother. We had at our station this spring something like ten and a half million perch eggs in Downing jars, two and a half quarts to the jar, and during most of the time we had to feather them twice a day to remove the silt.

MR. TITCOMB: Where floating boxes are used it is better to have them in a current such as that of a river. In a lake or where there is no current I think that roily water would cause trouble.

MR. DOWNING: The water was unusually roily this year.

MR. TITCOMB: Under such conditions the eggs would have to be feathered.

DR. BARTON W. EVERMANN: Mr. Bower asked me a question regarding the geographic distribution of yellow perch. It is abundant all across the northern portion of the United States from New Brunswick to the Lake of the Woods and perhaps Lake Winnipeg, and then south through the lakes of Minnesota, Iowa, and the eastern part of the Dakotas; in Northern Illinois, Northern Indiana and all through the Great Lakes region. I think it is not native anywhere south of middle Indiana in the Mississippi Valley States, although it has been occasionally taken in the Wabash River. It is found down the Atlantic coast to the Potomac and perhaps slightly beyond. It has been introduced on the Pacific coast and is now abundant about Seattle and the various lakes in Washington, Oregon and California.

I notice in a paper recently prepared by the Census office, giving the fisheries product of the State of Oregon, that the catch of perch in Oregon was quite large. I know from personal observation that the yellow perch is very abundant in Washington, Union and Greenwood lakes and various lakes about Seattle.

To what extent the yellow perch may be introduced in more southern waters, of course, remains to be determined. The way to find out is to try it. But it is not a river fish in the Mississippi Valley as it is along the Atlantic coast, where it is both a lake and river fish.

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RECAPITULATION

Active	395
Life	14
Honorary	72
Corresponding	20
Total Membership	501

CONSTITUTION

(As amended to date.)

ARTICLE I.

NAME AND OBJECT.

The name of this Society shall be American Fisheries Society. Its object shall be to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of all interests of fish culture and the fisheries, and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II.

MEMBERS.

Any person shall, upon a two-thirds vote and the payment of two dollars, become a member of this Society. In case members do not pay their fees, which shall be two dollars per year after the first year, and are delinquent for two years, they shall be notified by the treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponing member upon a two-thirds vote of the members present at any regular meeting.

The President (by name) of the United States and the governors (by name) of the several States shall be honorary members of the Society.

Any person shall, upon a two-thirds vote and the payment of twenty-five dollars, become a life member of this Society, and shall thereafter be exempt from all annual dues.

ARTICLE III.

OFFICERS.

The officers of this Society shall be a president and a vice-president, who shall be ineligible for election to the same office until a year after the expiration of their term; a corresponding secretary, a recording secretary, an assistant recording secretary, a treasurer and an executive committee of seven, which, with the officers before named, shall form a council and transact such business as may be necessary when the Society is not in session—four to constitute a quorum.

ARTICLE IV.

MEETINGS.

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting, or, in default of such action, by the executive committee.

ARTICLE V.

ORDER OF BUSINESS.

1. Call to order by president.
2. Roll call of members.
3. Applications for membership.
4. Reports of officers.
    a. President.
    b. Secretary.
    c. Treasurer.
    d. Standing Committees.
5. Committees appointed by the president.
    a. Committee of five on nomination of officers for ensuing year.
    b. Committee of three on time and place of next meeting.
    c. Auditing committee of three.
6. Reading of papers and discussion of same.

(Note—a. In the reading of papers preference shall be given to the members present.

b. The president and two secretaries are empowered to arrange the papers of the meetings of this Society.)

7. Miscellaneous business.
8. Adjournment.

ARTICLE VI.

CHANGING THE CONSTITUTION.

The constitution of the Society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting, provided at least fifteen members are present at said regular meeting.